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# SELECTED WATER RESOURCES ABSTRACTS

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OFFICE OF WATER RESEARCH AND TECHNOLOGY

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A monthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 15, NUMBER 1
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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

# PREFACE

**Selected Water Resources Abstracts,** a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

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# SELECTED WATER RESOURCES ABSTRACTS

## 2. WATER CYCLE

### 2A. General

**PREDICTING LAKE LEVELS BY EXPONENTIAL SMOOTHING,**
Department of the Environment, Edmonton. Div. of Design and Construction.
S. D. Koppula.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY7, p 867-878, July, 1981. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Water level fluctuations, *Flood forecasting, *Lakes, Rainfall-runoff relationships, Model studies, Mathematical models, *Lesser Slave Lake, *Alberta, Planning, Prediction, Storm water, Water resources management, Flood plain management, Water level, Forecasting.

Future water levels of Lesser Slave Lake, Alberta, were estimated using the forecasting technique, Exponentially Weighted Moving Average (EWMA). These predictions are crucial for storm water management and land use in a lake district. Since monthly statistics on the levels of Lesser Slave Lake were available for 1913-1977, the first 720 observations were used to develop initial values for mean level in a given period, seasonal factor in a given period, and trend factor in a given period. The next 60 observations (1973-77) were used to test the forecasting model. Comparisons of the predicted vs. the observed values for 1973-77 showed a general agreement; largest deviations were 1.5 ft. The Box-Jenkins technique, harmonic analysis, and a combination of the two methods were compared with the EWMA model. The EWMA was consistently superior in its predictive value. The composite model was the most satisfactory of the other three methods; harmonic analysis, the least. (Cassar-FRC)
W82-00118

**CHARACTERIZING SHORT DURATION RAINFALL INTENSITIES FOR RUNOFF CALCULATION,**
Science and Education Administration, Beltsville, MD. Hydrology Lab.
E. T. Engman, and D. M. Hershfield.
Transactions of the ASAE, Vol 24, No 2, p 347-352, March-April, 1981. 13 Fig, 9 Ref.

Descriptors: *Runoff forecasting, *Rainfall distribution, Rainfall-runoff relationships, Hydrographs, Infiltration, Nonpoint pollution sources, Error analysis.

The error inherent in calculating peak runoff from hourly rainfall data is demonstrated by applying a model to actual rainfall events. As the actual rainfall distribution approaches the average hourly depth, the error approaches zero. Errors of over 50% occur when intensities are averaged over the hour so that no precipitation excess is calculated. A procedure was developed for simulating five-min rainfall increments from published hourly data. Using the corrected values gives runoff hydrographs much closer to the measured rainfall. At Colorado Springs, Colorado, 3.15 cm was measured, 3.02 cm simulated; and at Tyler, Texas, 2.58 cm measured and 2.36 cm simulated. The method is limited to storms of two hours or less duration. (Cassar-FRC)
W82-00142

**MODELING THE FLUX OF ATMOSPHERIC POLYCHLORINATED BIPHENYLS ACROSS THE AIR/WATER INTERFACE,**
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5B.
W82-00193

**MODELING THE RELATIONSHIP BETWEEN DEVELOPMENT AND STORM WATER AND NUTRIENT RUNOFF,**
Louisiana State Univ., Baton Rouge. Coastal Ecology Lab.
C. S. Hopkinson, Jr., and J. W. Day, Jr.
Environmental Management, Vol 4, No 4, p 315-324, July, 1980. 5 Fig, 5 Tab, 15 Ref.

Descriptors: *Storm water, *Urban runoff, *Nutrients, Eutrophication, Model studies, Simulation analysis, Runoff, Rainfall-runoff relationships, Agricultural land, Urbanization, Storm Water Management Model, Nonpoint pollution sources, Louisiana, Mississippi, Rivers, Swamps, Land use, Nitrogen compounds, Phosphorus compounds, Infiltration, Wetlands.

The EPA Storm Water Management Model was applied to the des Allemands swamp forest system in the headwaters of the Barataria Basin, Louisiana. The effects of changing land use patterns on storm water runoff were modeled. By 1995 urban land on the uplands will increase by 321%, primarily at the expense of agricultural land. This urbanization will cause storm water runoff rates to increase by 4.2 fold. Nutrient runoff will increase 28% for N and 16% for P. Lake eutrophication will be a problem unless corrective actions are taken. (Cassar-FRC)
W82-00260

**THE CONSERVATIVE EFFECT OF RAINFALL VARIATION ON FERTILISER RESPONSE IN A HUMID ENVIRONMENT,**
New South Wales Dept. of Agriculture, Wollongbar (Australia).
G. J. Murtagh.
Search, Vol 11, No 1/2, p 35-36, January/February, 1980. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Rainfall-runoff relationships, *Fertilizers, *Pastures, Humic areas, Runoff, Soil water, New South Wales, *Australia, Effects, Rainfall rate.

Increased rainfall associated with cyclonic activity was relatively unimportant in maintaining soil water supplies and response to fertilizer in pasture in the subtropical coastal areas of New South Wales, Australia. Since 1946 annual rainfall has increased significantly in the two study areas. Most of the excess rain fell when soil was wettest in February-April. After adjusting for runoff, fertilizer responses increased by only small amounts. This is not true in drier inland areas where runoff losses are less. (Cassar-FRC)
W82-00316

**EFFECTS OF TILLAGE AND GYPSUM INCORPORATION ON RAIN RUNOFF AND CRUST STRENGTH IN FIELD SOILS IRRIGATED WITH SALINE-SODIC WATER,**
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
H. Frenkel, and A. Hadas.
Soil Science Society of America Journal, Vol 45, No 1, p 156-158, 1981. 2 Tab, 16 Ref.

Descriptors: *Irrigation effects, *Rainfall-runoff relationships, *Soil strength, Irrigation, Runoff, Rainfall, *Gypsum, Erosion control, Infiltration, Cropland, *Saline water, Infiltration rate, Permeability, *Negev Desert, Israel.

The northwestern part of the Negev Desert of Israel is increasingly irrigated with saline-sodic waters, introducing sodium into the exchange complex of the soil and possibly reducing infiltration rates and water permeability of the soil. The addition of gypsum in the fall to prevent dispersion and crust formation during the rainy season is recommended. The effects of each of two methods for incorporating gypsum on rain runoff and crust strength were investigated in two fields irrigated with saline-sodic water (electrical conductivity: 5.8 mmhos per centimeter; sodium adsorption rate (SAR): 18) and with fresh water (electrical conductivity: 0.95; SAR: 2.6). The first method involves spreading gypsum on the soil surface after tillage operations and disking it into the top 5 centimeters on ridges that are being built. The second method involves plowing a large amount of gypsum into the soil once every few years, after which the area is left in a very rough state. Runoff was reduced to a minimum (3%) when the soil surface was left in a rough state. When ridging patterns were used, up to 40% of the rainfall per storm was lost, regardless of the direction of the ridge with respect to the area gradient or to gypsum application. These results were obtained from adjacent fields having a general slope of 1% and an annual mean rainfall of 371 mm. The results indicate that surface roughness is far more important than amendments in reducing rainfall runoff. (Carroll-FRC)
W82-00327

**GROUND-WATER RESOURCES OF THE WHITE RIVER BASIN, MADISON COUNTY, INDIANA,**
Geological Survey, Indianapolis, IN. Water Resources Div.
W. W. Lapham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-109844, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-35, June 1981. 112 p, 42 Fig, 9 Tab, 16 Ref.

Descriptors: Groundwater, *Aquifer characteristics, *Groundwater movement, Glacial drift, Groundwater recharge, Water level fluctuations, Estimating, Hydraulic properties, Seepage, Hydrologic budget, *Model studies, Simulations, Groundwater availability, *Groundwater potential, Water yield, Pumping, Observation wells, Surface-groundwater relations, *Indiana, Madison County, *White River basin.

The ground-water resources of the White River basin in and near Madison County, Ind., were investigated by mapping the aquifers, estimating their hydraulic properties, determining the distribution of potentiometric head in the aquifers, and estimating some of the components of the ground-water budget from data collected in the field. This information was used to construct and calibrate a five-layer digital groundwater flow model. The model was used to provide estimates of the ground-water potential in terms of yield, drawdown, and streamflow depletion. Four confined sand and gravel aquifers interbedded in the glacial drift, a bedrock aquifer, and an unconfined outwash aquifer are the three most important aquifer systems in the study area. Model analysis of eight pumping plans provide a general assessment of the water-yielding potential of the three major aquifer systems in the study area. Model results indicate that, at some locations, yields of as much as 2.5 million gallons per day can be developed. Model simulations also indicate that only pumping near the small streams will reduce streamflow by more than a few percent. In developing the ground-water system in the area, use of many small, scattered well fields that produce less than about 3 million gallons per day, may be more favorable hydrologically than a few, heavily pumped well fields, like the well field northwest of Anderson. (USGS)
W82-00412

**WATER IN THE ELIZABETHTOWN AREA - A STUDY OF LIMESTONE TERRANE IN NORTH-CENTRAL KENTUCKY,**
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W82-00413

**PREDICTED EFFECTS ON GROUND WATER OF CONSTRUCTION OF DIVIDE CUT SECTION, TENNESSEE-TOMBIGBEE WATERWAY, NORTHEASTERN MISSISSIPPI USING A DIGITAL MODEL,**
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W82-00428

### 2B. Precipitation

**RAINWATER GAUGE,**
A. C. Abele.

U.S. Patent No. 4,233,841, 7 p, 9 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 909, November 18, 1980.

Descriptors: *Patents, *Instrumentation, *Rain gages, Weather, Protection, Housing.

A weather instrumentation station includes a louvered instrument housing containing the weather instruments. An exterior double-walled housing radiation shield is placed over the instrument housing to shield the instrument housing from the sun. A double-walled auxiliary shield may be positioned over at least one side of the housing shield to shield sun rays from the instrument housing on the open side. The housing shield and the auxiliary shield inner walls are formed of thermoplastic or aluminized asbestos material, and the outer walls of stainless steel. The housing shield roof is peaked to forestall accumulation of water and snow. There is also provided a rainwater gauge including a receiving flask with a funnel to channel the rainwater. The ratio of the area of the funnel top inlet opening to its lower outlet opening is preferably ten to one. An elongated, hollow, open-ended, stainless steel cylinder of minimal length may be connected to the perimeter of the funnel upper inlet opening to channel rainwater to the funnel lower outlet opening. The cylinder upper edge is a knife edge to ensure collecting a precise are of rainwater. (Sinha-OEIS)
W82-00068

**SOME LIMITING FORMS OF THE POISSON DISTRIBUTION OF ANNUAL STATION PRECIPITATION,**
Massachusetts Inst. of Tech., Cambridge.
P. S. Eagleson.
Water Resources Research, Vol 17, No 3, p 752-757, June, 1981. 7 Fig, 10 Ref.

Descriptors: *Storms, *Rainfall, Variability, Precipitation, Poisson ratio, Arid climates, Humid climates, Comparison studies.

Annual station precipitation is represented as a seasonally stationary Poisson arrival process in terms of three random variables: season length, number of storms, and storm depth. The contribution of each factor to variance of the annual total precipitation is determined, and the limiting distribution of the total precipitation derived by letting each variable vanish separately. Three cases are studied using data from Boston, Massachusetts; Pasadena, California; and Riyadh, Saudi Arabia. In humid climates the storm depth variability is the predominant contributor to variance in annual rainfall. In arid climates the variability of number of storms per rainy season is the controlling factor; distribution is highly skewed. These findings are useful in studies of extreme climates, where data is often scarce. (Cassar-FRC)
W82-00132

**REPORT ON THE SUMMER MONEX FIELD PHASE,**
National Science Foundation, Washington, DC.
J. S. Fein, and J. P. Kuettner.
Bulletin of the American Meteorological Society, Vol 61, No 5, p 461-474, May, 1980. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Monsoons, *Precipitation, *Rainfall, Weather, India, Satellite technology, Air circulation, Seasonal variation, Wet seasons, Winds, Cyclones, Meteorology, Data collections, Heat budget, Heat, Temperature, Asia, Foreign countries, Floods, Global Weather Experiment, MONEX, Indian Ocean.

The 1979 Summer Monsoon Experiment (MONEX) was designed to study the monsoon in the Indian Ocean and adjacent land areas using satellite and land-based measurements. The Indian monsoon of 1979 was substantially subnormal in precipitation over some inland areas, two weeks late in arriving, and early to break up. The southwest monsoon established fully over the Arabian Sea in July. The Bay of Bengal branch developed on schedule in late May, but later weakened, strengthening again on July 7. Break monsoon conditions developed after July 13. A cyclone in early August caused floods, crop damage, and loss of lives. After this event, the monsoon rains declined. Over Saudi Arabia and in the Arabian Sea, where differential heating of sea and land masses initiates the monsoon, differential heating, total heat budgets, and the structure of an intense heat low and its diurnal changes were studied. During this period soil temperatures as high as 70C were measured. Sea surface temperatures were 28C near shore and 30-34C off shore. The role of planetary-scale variation in controlling the monsoon was striking. The low-level Central Indian Ocean branch of the Somali jet was believed responsible for bringing the monsoon into southern India. Surges from the Southern Hemisphere were observed. Personnel from many U.S. and foreign educational and research institutions participated in the project. Combined MONEX and Global Weather Experiment data should provide unprecedented data for a basic study of monsoons. (Cassar-FRC)
W82-00265

**RECENT VARIATIONS IN WINTER EXTRATROPICAL CYCLONE ACTIVITY FOR THE AUSTRALIAN REGION,**
Adelaide Univ. (Australia). Dept. of Geography.
A. M. Carleton.
Search, Vol 11, No 1/2, p 37-39, January/February, 1980. 3 Fig, 4 Ref.

Descriptors: *Cyclones, *Precipitation, *Weather patterns, *Australia, Satellite technology, Indian Ocean, Tasman Sea.

Satellite infrared imagery for the winters of 1973-1977 in southern Australia was analyzed using the vortex classification system for extratropical cyclonic cloud vortices. The 1975 winter was nearest to the average in precipitation; 1973 and 1974 had above average precipitation and 1975-1976, below average precipitation. These precipitation trends were related to the longitudinal and latitudinal variations in satellite-observed activity. The longitudinal and latitudinal distribution of cyclogenesis was more critical in explaining the anomalies than its frequency. Fluctuations in the intensity of location of the Indian Ocean trough appeared to be the key circulation factor, with the cyclogenetic zone in the Tasman Sea another important factor. (Cassar-FRC)
W82-00315

**HISTORICAL NILE FLOODS AND THEIR IMPLICATIONS FOR CLIMATIC CHANGE,**
Washington State Univ., Pullman. Dept. of Anthropology.
For primary bibliographic entry see Field 2E.
W82-00326

## 2C. Snow, Ice, and Frost

**EFFECTS OF VOLCANISM ON THE GLACIERS OF MOUNT ST. HELENS,**
Geological Survey, Tacoma, WA. Water Resources Div.
M. M. Brugman, and A. Post.
Available from the Branch of Dist., USGS, 604 Pickett St. Alexandria, VA 22304. Geological Survey Circular 850-D, 1981. 11 p, 8 Fig, 2 Tab.

Descriptors: *Volcanoes, *Glaciers, *Snow, *Ice, Snowmelt, Snow cover, Firn, Runoff, Craters, Mountains, *Washington, *Mount St. Helens, Volcanic ash, Pyroclastic flows, Effects.

The cataclysmic May 18, 1980, eruption of Mount St. Helens removed 2.9 square kilometers of glacier snow and ice including a large part of Shoestring, Forsyth, Wishbone, Ape, Nelson, and all of Loowit and Leschi Glaciers. Minor eruptions and bulging of the volcano from March 27 to May 17 shattered glaciers which were on the deforming rock and deposited ash on other glaciers. Thick ash layers persisted after the May 18 eruption through the summer on most of the remaining snow and ice, and protected winter snow from melting on Swift and Dryer Glaciers. Melting and recrystallization of snow and ice surviving on Mount St. Helens could cause lubricate mudflows and generate outburst floods. Study of glaciers that remain on this active volcano may assist in recognizing potential hazards on other volcanoes and lead to new contributions to knowledge of the transient response of glaciers to changes in mass balance or geometry. (USGS)
W82-00007

**ON THE ESTIMATION OF ANTARCTIC ICEBERG MELT RATE,**
Oregon State Univ., Corvallis. School of Oceanography.
S. Neshyba, and E. G. Josberger.
Journal of Physical Oceanography, Vol 10, No 10, p 1681-1685, October, 1980. 2 Fig, 17 Ref.

Descriptors: *Antarctic Ocean, *Icebergs, *Melting, Ice, Sea ice, Water quantity, Water supply, Water supply development, Iceberg towing.

Minimum sidewall melt rate of Antarctic icebergs, of possible interest to engineers towing icebergs, was determined after evaluating errors of various methods--field observations, iceberg distribution statistics, laboratory experiments, and theoretical studies. This evaluation permits quantitative first-order correction for the effect of bubbles released from the melting ice on the convective heat transfer and the effect of other forms of iceberg deterioration, besides sidewall melting. At temperatures of 2, 3, 4, 8, and 12C best estimates of melt rates were 5, 10, 17, 55, and 100 meters per year, respectively. (Cassar-FRC)
W82-00166

**AERIAL BIOMASS DISTRIBUTION IN AN UNDISTURBED AND DISTURBED SUBARCTIC BOG,**
Great Lakes Forestry Research Center, Sault Ste. Marie (Ontario).
R. A. Sims, and J. M. Stewart.
Canadian Journal of Botany, Vol 59, No 5, p 782-786, May, 1981. 1 Fig, 1 Tab, 17 Ref.

Descriptors: *Bogs, *Clear-cutting, Peat bogs, *Biomass, Distribution, Vegetation, Ice, Revegetation, Erosion, Frozen ground, Permafrost, *Subarctic zone.

The differences in aerial biomass between an uncleared and cleared portion of a subarctic treed peat plateau at a single site were measured. A portion of a wooded peat plateau in northern Manitoba was stripped of surface vegetation during powerline construction. Seven years after the clearing of the land, the aerial biomass of the plants growing on the disturbed surface was estimated to be 2098 kg/ha. This figure is only 26.4% of the undisturbed portion's biomass. Surface erosion of the peat was visible. Disturbance of the surface does accelerate erosion and may initiate thawing and deterioration of the ice core. In the study area, tree biomass represented 28.7% of the aboveground biomass. Photosynthetic biomass was 17% in the wooded area and 53% in the disturbed area. Major ericaceous species increased after the clearing of the area. The permafrost persisted at the same depth under the disturbed part as under the adjacent forested part. (Small-FRC)
W82-00211

**ICE PROBLEMS AT A COOLING WATER INTAKE IN A TIDAL ESTUARY AT LINGAN, N.S.,**
Albery, Pullerits, Dickenson and Associates Ltd., Don Mills (Ontario).
For primary bibliographic entry see Field 8A.
W82-00230

**ILLUSTRATION OF THE ROLES OF SNOW IN THE EVOLUTION OF THE WINTER COVER OF A LAKE,**
Trent Univ., Peterborough (Ontario). Dept. of Geography.
W. P. Adams, and N. T. Roulet.
Arctic, Vol 33, No 1, p 100-116, March, 1980. 14 Fig, 12 Ref.

Descriptors: *Slush, *Lake ice, *Snow cover, Cycles, Ice cover, Temperature, Fluctuations, Lakes, Snow, Iced lakes, Ice, Melting, *Spatial distribution, Lentic environment, Winter, Elizabeth Lake, Labrador.

A survey of spatial patterns of snow and ice cover on Elizabeth Lake, Labrador, was conducted in February of 1979. Relationships between snow cover, black ice and white ice (produced by slushing) were examined by SPSS and SYMAP computer maps and programs. Snow cover had two general effects on the patterns of ice cover; it produced an insulating effect which slowed the growth of the underlying ice cover, and it also depressed the sheet of ice below the hydrostatic water level, allowing slushing to occur and thus promoting the growth of white ice. Data from Lake Elizabeth showed agreement with these general patterns upon computer analysis. Areas of lower snow cover represented areas where slushing had occurred due to snow depression of the ice surface and incorporation of snow into slush ice formation. Distributions of white ice on the lake's surface were also found to correspond to snow drifting trends controlled by a west-northwest prevailing wind. Black ice thickness generally decreased towards lake margins, while white ice thickness generally increased in these same areas. The cyclic nature of ice growth illustrated on Lake Elizabeth has great bearing on the nature of peak ice which occurs on the lake. (Geiger-FRC)
W82-00267

**SHALLOW CORE SNOW CHEMISTRY OF ATHABASCA GLACIER, ALBERTA,**
New Hampshire Univ., Durham. Dept. of Earth Sciences.
D. Butler, W. B. Lyons, J. Hassinger, and P. A. Mayewski.
Canadian Journal of Earth Sciences, Vol 17, No 2, p 278-281, 1980. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Glaciers, *Chemical composition, Chemical analysis, Ice, Glacier mass balance, Glacier balance, Glacial sediments, Nitrates, Phosphates, Snow, Chemistry of precipitation, *Athabasca Glacier.

Samples were taken from the Athabasca Glacier on August 24, 1978, in the accumulation zone close to the 1978 summer equilibrium line altitude and just above the third icefall at an elevation of 2694 meters. The NO3(-) and PO4(3-) values from Athabasca Glacier ice are much lower than those reported for snow samples from central Alberta. The increased reactive SiO2 values in the central Alberta snows suggest that reactive SiO2 can be introduced into the atmosphere and incorporated into snow and ice by man's activities. The mean Si/Fe ratio from the Athabasca ice is low when compared to those of atmospheric aerosols and the central Alberta snow samples. The mean NO3(-)/PO4(3-) ratio is about twice that of the central Alberta snows, suggesting that anthropogenically diluted aerosols may contain higher concentrations of PO4(3-) relative to NO3(-) than unpolluted air. The NO3(-)/PO4(3-) and SiO2/Fe ratios proceed through maxima at 2.5 and 6-6.5 meters depth in the sample pit. The glacier's yearly net mass balance for the sample area was 1.5 and 2.4-2.7 meters water equivalent for the 1976-1977 and 1977-1978 mass balance years. (Baker-FRC)
W82-00320

## 2D. Evaporation and Transpiration

**A PROPOSED TECHNIQUE TO MEASURE EVAPOTRANSPIRATION USING MICROMETEOROLOGICAL METHODS,**
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Agrometeorology.
K. L. Bristow, and J. M. De Jager.
Water SA, Vol 7, No 1, p 49-53, January, 1981. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Measuring instruments, *Mathematical equations, *Evapotranspiration, Anemometers, Radiometry, Evaporation, Evaporation gauges, Irrigation requirements, Transpiration, Water loss, Energy, Plant-water relationships.

Accurate measurements of crop evapotranspiration are vital to irrigation project managers and researchers in the field of plant-water relationships. A method is described for estimating evapotranspiration using two sets of recording wet- and dry-bulb thermometers and an anemometer. In initial field work on wheat crops conducted over a six day period, a net radiometer was employed, which could be replaced by a sunshine duration recorder. Crop evaporation was compared to pan evaporation, and computed surface temperatures gave good agreement with temperatures measured at the momentum exchange surface. Collected data was plugged into the surface energy budget equation, while a reiterative technique was used to calculate a surface temperature to balance this expression. Through conversion of the latent heat flux term in the balanced equation to a volumetric evaporation, the amount of evapotranspiration was determined. The necessary mathematical data may be computed on a programmable calculator, and the durable equipment can be installed and maintained by untrained personnel. (Geiger-FRC)
W82-00183

**FIELD TEST OF AN IRRIGATION SCHEDULING COMPUTER MODEL,**
Soil and Irrigation Research Inst., Pretoria (South Africa). Dept. of Agriculture and Fisheries.
For primary bibliographic entry see Field 3F.
W82-00184

**REDUCED TRANSPIRATION AND INCREASED WATER EFFICIENCY BY DIURON IN CORN (ZEA MAYS),**
Guelph Univ. (Ontario). Dept. of Environmental Biology.
S. Ahmed, and R. A. Fletcher.
Weed Science, Vol 28, No 2, p 180-185, March, 1980. 5 Fig, 5 Tab, 16 Ref.

Descriptors: *Transpiration control, *Diuron, *Herbicides, *Corn, Water use efficiency, Drought resistance, Drought, Crop production, Agriculture.

The effectiveness of low concentrations of a representative phenoxy, triazine, and urea herbicide were evaluated in reducing transpiration and increasing water efficiency in corn production. Diuron (3-(3,4-dichlorophenyl)-1,1-dimethylurea) was the most effective herbicide on both monocotyledon and dicotyledon species. A 40% reduction in transpiration occurred. At all stages of corn growth, foliar applications of low concentrations (0.035 to 0.56 kg/ha) effectively reduced transpiration. For 16 days after treatment, the lower leaves of the corn plants did not wilt and become senescent. Diuron increased water efficiency and this effect was more pronounced when water was limiting. Treated plants used 68% less water than controls for each gram of shoot dry weight produced. Diuron may reduce transpiration and maintain yields in drought periods under field conditions. (Small-FRC)
W82-00196

## 2E. Streamflow and Runoff

**CHANNEL CONDITIONS IN THE LOWER TOUTLE AND COWLITZ RIVERS RESULTING FROM THE MUDFLOWS OF MAY 18, 1980,**
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W82-00004

**REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1980 WATER YEAR,**
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 6E.
W82-00012

**FLOOD DATA FOR THE SACRAMENTO RIVER AND BUTTE BASIN 1875 TO 1978, SACRAMENTO VALLEY, CALIFORNIA,**
Geological Survey, Menlo Park, CA. Water Resources Div.
J. C. Blodgett.
Available from the OFSS, USGS Box 25425 Fed. Ctr., Denver, CO 80225, Price: $26.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-971, June 1981. 193 p, 10 Fig, 17 Tab, 17 Ref.

Descriptors: *Flood data, *Historic floods, *Flood stages, *Flood profiles, Flow duration, Streamflow, Flood peak, Overflow, Flood discharge, Discharge measurement, Gaging stations, Cross sections, *California, *Sacramento River, *Butte Basin.

Streamflow data at various locations were assembled for the Sacramento River between Red Bluff and Meridian, Calif., and for Butte Basin, which serves as an overflow basin during periods of flooding. Data were obtained from various Federal and State agencies and private sources to document the magnitude of flooding from 1875 to 1978. The assembled data include annual maximum flood stages and discharges for the period of record at gaging stations, and flood stages at numerous staff gages, crest-stage gages, and high-water mark sites throughout the study area. Tabulations of flood-flow measurements made at or near gaging stations, including the cross-sectional area of the channel and velocities, are presented. Cross sections of the Sacramento River near Chico Landing surveyed in 1978 and earlier surveys to show the size of Butte Basin have been included. A detailed list of references is presented giving the sources of the data included in this report. Many of these sources present detailed descriptions of flooding at various sites. (USGS)
W82-00019

**THE INFLUENCE OF STREAM ORDER AND SELECTED STREAM BED PARAMETERS ON FISH DIVERSITY IN RAYSTOWN BRANCH, SUSQUEHANNA RIVER DRAINAGE, PENNSYLVANIA,**
Maryland Univ., Frostburg. Appalachian Environmental Lab.
T. Y. Barila, R. D. Williams, and J. R. Stauffer, Jr.
Journal of Applied Ecology, Vol 18, No 1, p 125-131, April, 1981. 1 Fig, 3 Tab, 19 Ref.

Descriptors: *Stream order, *Diversity indices, *Fish populations, Species diversity, Raystown Branch, Susquehanna River, *Pennsylvania, Stream biota, Aquatic animals.

Stream order proved a satisfactory composite index for correlation with fish diversity in a study of Raystown Branch of the Susquehanna River, Pennsylvania. The following parameters were studied in August and October, 1978, at each of 36 stations along the 165 km length: diversity index, stream order, gradient, maximum width, narrowest width, mean width, mean depth, maximum depth, altitude, total species, total individuals, and 6 most commonly occurring species. Diversity was most highly correlated with stream order, increasing with first through fourth order streams. Fifth order streams had a slightly lower mean diversity index, possibly caused by migration into lower order streams for spawning or problems with sampling. Other physical variables showed predictable relationships with diversity and stream order. (Cassar-FRC)
W82-00109

**CHARACTERIZING SHORT DURATION RAINFALL INTENSITIES FOR RUNOFF CALCULATION,**
Science and Education Administration, Beltsville, MD. Hydrology Lab.
For primary bibliographic entry see Field 2A.
W82-00142

**FLOW RESISTANCE IN VEGETATED WATERWAYS,**
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
N. Kouwen, R-M. Li, and D. B. Simons.
Transactions of the ASAE, Vol 24, No 3, p 684-690, 698, May/June, 1981. 8 Fig, 2 Tab, 29 Ref.

Descriptors: *Flow resistance, *Vegetation effects, Streamflow, Plant growth, *Channel flow, Model studies.

A new method to determine the flow capacity of a vegetated channel is presented. The method uses the vegetation's length and stiffness as parameters. Graphs of field data of Manning's coefficient versus the product VR (velocity times hydraulic radius) can be accurately reproduced. A table of stiffness values for various types of vegetation for which flow data were available is included. It is shown that the n-VR method of channel design currently in use is based on the correct premise that n is a function of VR regardless of the relative values of V and R. The limitations of the n-VR method are stated. The advantage of the new method is that it is a numerical method which can be easily incorporated in computer programs for other purposes such as backwater or routing models. (Baker-FRC)
W82-00152

**AMOUNTS AND RELATIVE SIGNIFICANCE OF RUNOFF TYPES IN THE TRANSPORT OF NITROGEN INTO A STREAM DRAINING AN AGRICULTURAL WATERSHED,**
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W82-00173

**POLLUTION FROM LAND RUNOFF,**
Great Lakes Basin Commission, Ann Arbor, MI.
For primary bibliographic entry see Field 5B.
W82-00253

**HISTORICAL NILE FLOODS AND THEIR IMPLICATIONS FOR CLIMATIC CHANGE,**
Washington State Univ., Pullman. Dept. of Anthropology.
F. A. Hassan.
Science, Vol 212, No 4499, p 1142-1145, June 5, 1981. 2 Fig, 1 Tab, 32 Ref.

Descriptors: *Flooding, *Climatology, *Weather patterns, *Nile floods, Africa, Flood stages, History, Rainfall-runoff relationships, Flood stages.

Although records of Nile flood stages are available for the period from the 7th century A.D. to the present, past attempts to understand the implications of variations in Nile floods for climatic change have been unsatisfactory. This study used three different analytic techniques to detect episodic variations in flood stages, following which an attempt was made to determine the cause of the variations and to relate flood episodes to climate in Africa and Europe. Major episodes of low Nile discharge were noted during the years 930 to 1070 and 1180 to 1350. Major episodes of high Nile floods occurred from 1070 to 1180 and from 1350 to 1470. Short-term fluctuations in Nile flood maxima appear to reflect variations in the contributions from the White Nile, which drains a large area of equatorial Africa, and to match variations in water levels of Lake Chad, which are associated with the poleward movement of the intertropical convergence zone. Therefore, it is concluded that the episodic variations in Nile flood discharge are probably the result of climatic changes that influence precipitation in equatorial Africa. Comparison of data on Nile flood stages, including those for scattered periods prior to the 7th century A.D., indicate that there is also a correlation between low Nile discharge and cold climate in Europe. (Carroll-FRC)
W82-00326

**USE OF FLOW-DURATION CURVES TO EVALUATE EFFECTS OF URBANIZATION ON STREAMFLOW PATTERNS ON LONG ISLAND, NEW YORK,**
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 4C.
W82-00416

## 2F. Groundwater

**GROUND-WATER DATA FOR MICHIGAN, 1979,**
Geological Survey, Lansing, MI. Water Resources Div.
G. C. Huffman.
Geological Survey Open-File Report 80-1212, 1980. 56 p, 4 Fig, 3 Tab, 120 Ref.

Descriptors: *Groundwater resources, *Michigan, *Water levels, *Aquifers, *Water quality, Water wells, Water yield, Water utilization, Well data, Hydrogeology, Hydrographs, Water level fluctuations, Water analysis, Chemical analysis, Data collections.

This report summarizes data on water levels in 138 observation wells in Michigan and provides information on well locations, depths, altitudes, and aquifers that they tap. Tabulated data include extremes of water levels for 1979 and for the period of record. Also tabulated is the pumpage of most major ground-water users in the State and quality data on selected wells sampled during 1979. In most areas, ground-water levels followed precipitation trends. In areas where precipitation was above normal, such as in the northern part of the State, ground-water levels were generally above average. Elsewhere levels were below average. (USGS)
W82-00014

**JANUARY 1980 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,**
Geological Survey, Lawrence, KS. Water Resources Div.
M. E. Pabst.
Geological Survey Open-File Report 80-958, August 1980. 100 p, 2 Tab.

Descriptors: *Groundwater, *Water level, *Observation wells, *Water level fluctuations, *Irrigation, Groundwater recharge, Aquifers, Hydrologic data, *Kansas, Western Kansas, South-central Kansas.

Water-level measurements were made, mostly in January 1980, in about 1,240 observation wells in western and south-central Kansas. The measurements were made in mid-winter when pumping was minimal and water levels had recovered from the effects of pumping during the previous irrigation season. Annual hydrologic data are provided for relating water-level changes from a 'base-reference year' (predevelopment year), a year of abnormally high rainfall and minimum pumpage (1966), and the previous year (1979). The 'base-reference year' is designated at 1950 for the northwestern and westcentral areas, 1940 for the southwestern area, and 1944 for the south-central area. Water level data in the south-central area also are compared with data for 1974. 'Base-reference-year' water levels are based on measurements made during that year and on interpretation of water-table maps. Data also are provided for relating the average annual water-level changes, saturated thicknesses of the deposits, and percentage changes in saturated thicknesses. (USGS)
W82-00016

**GROUNDWATER AVAILABILITY IN ACADIA NATIONAL PARK AND VICINITY, HANCOCK AND KNOX COUNTIES, MAINE,**
Geological Survey, Boston, MA. Water Resources Div.
B. P. Hansen.
Geological Survey Open-File Report 80-1980. 8 p, 3 Fig, 12 Ref.

Descriptors: *Groundwater availability, *Water yield, *Wells, *Aquifer characteristics, Geohydrology, Water quality, Saline-freshwater interfaces, Bedrock, Geologic fractures, *Maine, Arcadia National Park, Hancock County, Knox County.

This report presents the results of a preliminary investigation of grund-water availability in Acadia National Park and vicinity, Hancock and Knox Counties, Maine. In general, yield of water from individual wells in unconsolidated surficial deposits is low (0-10 gallons per minute). Several small, unconsolidated deposits may yield moderate quantities (50-100 gallons per minute) but these have not been adequately tested. Yields from 160 wells in the crystalline bedrock range from 0.5 to 100 gallons per minute, with a median yield of 10 gallons per minute. Wells in zones of extensive fracturing or faulting generally have higher than average yields. Zones of fracturing may correspond to lineations which have been mapped by interpretation from topographic maps and aerial photographs. In general, ground water is of suitable chemical quality for public supply. Most ground water is low in dissolved solids and is soft. Iron exceeds 0.3 milligram per liter and manganese exceeds 0.5 milligram per liter in water from some wells. Brackish (salty) water is present in only a few wells at the coast or adjacent to saltwater bodies. Elevated concentrations of Radon-222 have been reported from wells in the granite aquifer. (USGS)
W82-00017

**EVALUATION OF GROUND-WATER MONITORING NETWORK, SANTA CRUZ COUNTY, CALIFORNIA,**
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W82-00023

**POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT, FLORIDA, MAY 1980,**
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00024

**POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN THE NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT, MAY 1980,**
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00025

**AQUIFER PARAMETER IDENTIFICATION WITH OPTIMUM DIMENSION IN PARAMETERIZATION,**
California Univ., Los Angeles. School of Engineering and Applied Science.
W. W-G. Yeh, and Y. S. Yoon.
Water Resources Research, Vol 17, No 3, p 664-672, June, 1981. 11 Fig, 4 Tab, 16 Ref.

Descriptors: *Aquifer characteristics, *Transmissivity, *Parametric hydrology, Hydrology, Optimization, Unsteady flow, Groundwater movement.

A method has been developed for parameter identification in a 2-dimensional, unsteady state groundwater flow. The optimum trade-off between the modeling error and the error associated with the parameter uncertainty may be directly determined without relying on prior geologic information on the aquifer. The coefficients to be identified are transmissivities which vary spatially. Finite elements are used to represent the unknown transmissivity function parametrically as nodal values over a suitable discretization of a flow region. A modified Gauss-Newton algorithm is used for parameter optimization. Covariance analysis estimates the reliability of the estimated parameters. Modeling errors, as represented by a least squares criterion, generally decrease with increases in dimension of the unknown parameter, but errors in data are propagated to a greater degree into the estimated parameters, reducing the reliability of the estimations. This method is shown to be more reliable than the pure zonation method. Two cases illustrate the method for determining the optimum dimension in parameterization. (Cassar-FRC)
W82-00131

**HYDRAULIC PROPERTIES OF COAL AND RELATED MATERIALS, NORTHERN GREAT PLAINS,**
North Dakota Univ., Grand Forks. Engineering Experiment Station.
B. W. Rehm, G. H. Groenewold, and K. A. Morin.
Ground Water, Vol 18, No 6, p 551-561, November-December, 1980. 5 Fig, 3 Tab, 29 Ref.

Descriptors: *Coal, *Hydraulic properties, *Groundwater, *Mining engineering, *Monitoring, Aquifers, Porosity, Flow, Coal mining, Permeability, Geologic fractures, Drawdown, Water level, *Strip mine wastes, Sand aquifers, Hydraulic conductivity, Coal aquifers.

Data from five study areas where coal and sand beds form important aquifers in the northern Great Plains Region have been summarized. Both sand and coal have similar hydraulic conductivities and specific storage values. Aquitards in the region consist of clay and silt, fractured to varying degrees and with a wide range of conductivities. The hydraulic conductivity of strip mine spoils has a six order of magnitude range, with a mean of 8 x 10 to the minus seventh power meters per second. Variability is related to contouring, seasonal variations, and spatial variation of spoil lithology. The hydraulic properties of coal bearing units vary both within and between mines. Disregard for the heterogeneities of a coal aquifer can result in problems in the development of a dewatering plan and in the prediction of the effect of the mine on local water supply wells. (Titus-FRC)
W82-00278

**GROUND-WATER MODELING: RECENT DEVELOPMENTS,**
GeoTrans, Inc., Reston, VA.
C. R. Faust, and J. W. Mercer.
Ground Water, Vol 18, No 6, p 569-577, November-December, 1980. 2 Fig, 2 Tab, 40 Ref.

Descriptors: *Groundwater, *Computer programs, *Model studies, *Hydrogeology, *Calibrations, Mathematical models, Technology, Computer models, Computer applications, Flow, Data interpretation, Mathematical analysis.

Recent developments in groundwater modeling are reviewed. Current research in this field is influenced by two factors, the state of model evolution and computer capabilities. Groundwater flow in saturated porous media is an area for which models are well-developed because confidence in the results is high. The problem of data adequacy is being addressed in research on parameter estimation. In addition, transport modeling and the boundary integral method, a new solution technique, are the focus of current research efforts. The need to develop accessible models and convenient computer techniques is growing as more uses are found for these tools in hydrology and in administrative professions. (Titus-FRC)
W82-00281

**GROUND-WATER FLOW AND URANIUM IN COLORADO PLATEAU,**
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
N. V. Ortiz, J. A. Ferentchak, F. G. Ethridge, H. C. Granger, and D. K. Sunada.
Ground Water, Vol 18, No 6, p 596-606, November-December, 1980. 17 Fig, 2 Tab, 19 Ref.

Descriptors: *Flow, *Porosity, *Uranium, *Geochemistry, *Groundwater, Hydrogeology, Aquifers, Finite difference methods, Piezometers, Flumes, Pumps, Data interpretation, Permeability, Precipitate, *Colorado Plateau, Ore deposits.

The precipitation of humates at the interface between a humic acid solution and an aluminum potassium sulfate solution was studied in porous media models to gain some insight into the deposition of Colorado Plateau type uranium deposits. The effects of variable flow rates, porous-media layering, mudstone lenses, fluid density differences, and geochemical reactions on the flow phenomenon and the resulting precipitate were evaluated. A numerical model was developed to predict the shape and location of the interface where precipitation occurs. The precipitate of the humic material was found to occur both parallel and perpendicular to the general flow path, at the interface between two solutions. Results also indicate that the precipitate deposits are larger when the contact time between the two fluids is large. Any variation in flow rate can significantly influence the location of the precipitate. The association of precipitate bands with modeled sedimentary features and the similarities between these precipitate bands and actual deposits in the Colorado Plateau suggest that these model studies provide data useful both in understanding and predicting the relations between tabular ore deposits and groundwater flow patterns. (Titus-FRC)
W82-00282

**GROUND-WATER INFORMATION: NWWA PROVIDES THE RESOURCES,**
National Water Well Association, Worthington, OH.
J. Poland.
Ground Water, Vol 18, No 6, p 541-543, November-December, 1980.

Descriptors: *Literature review, *Publications, *Information exchange, *Libraries, Groundwater, Reviews, Technology, Documentation, Information retrieval, Information systems, Rural areas, Developing countries.

The National Water Well Association's library and information center is developing a bibliographic data base of hydrogeological references. Resources of the library include over 9000 volumes of books, journals, reports, and newsletters. Information on developing countries as well as on rural America is available. In addition, computer searching and retrieval and manual searching services are offered. (Titus-FRC)
W82-00301

**POSSIBILITIES OF USING HELIUM AND TRITIUM SURVEYS FOR STUDYING RECHARGE CONDITIONS OF SUBSURFACE WATERS,**
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 7B.
W82-00302

**GARRETT COUNTY WATER-WELL RECORDS, CHEMICAL-QUALITY DATA GROUND-WATER USE, COAL TEST-HOLE DATA AND SURFACE-WATER DATA.**
Geological Survey, Towson, MD. Water Resources Div.
Maryland Geological Survey Water Resources Basic Data Report No 11, 1980. 102 p, 5 Fig, 2 Plates, 10 Tab, 21 Ref. (Compiled by Nutter, L. J., Smigaj, M. J., and Knobel, L. L.).

Descriptors: *Groundwater, *Hydrologic data, *Water quality, *Chemical analysis, Wells, Groundwater availability, Geologic units, Water use, Surface water, Flow measurement, Low flow, Flood frequency, *Maryland, Garrett County.

This report is a compilation of selected water-well records, selected spring records, gas-well records, chemical-quality data, water-use data, coal test-hole records, and surface-water data for Garrett County, Maryland. Included are records of about 1,100 water wells, 120 springs, 210 gas wells, 70 coal test holes, 56 chemical analyses of ground water, surface-water data from 8 continuous-record sites, and miscellaneous measurements from 11 sites. (USGS)
W82-00395

**ALTITUDE OF WATER TABLE, BISCAYNE AQUIFER, DADE COUNTY, FLORIDA, MAY 1980,**
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00409

**ALTITUDE OF WATER TABLE, BISCAYNE AQUIFER, DADE COUNTY, FLORIDA, OCTOBER 1979,**
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00410

**ALTITUDE OF WATER TABLE, BISCAYNE AQUIFER, DADE COUNTY, FLORIDA, MARCH 1979,**
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00411

**GROUND-WATER RESOURCES OF THE WHITE RIVER BASIN, MADISON COUNTY, INDIANA,**
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 2A.
W82-00412

**WATER-LEVEL RECORDS FOR THE NORTHERN HIGH PLAINS OF COLORADO, 1977-81,**
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00422

**HYDROGEOLOGIC DATA FROM TEST DRILLING NEAR VERNA BEACH, FLORIDA, 1978,**
Geological Survey, Tallahassee, FL. Water Resources Div.
M. Barker, G. Bowman, and H. Sutcliffe, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-634, 1981. 26 p, 7 Fig, 3 Tab, 5 Ref.

Descriptors: *Water quality, *Observation wells, *Rotary drilling, *On-site data collections, *Geohydrology, Lithologic logs, Water sampling, Chemical analysis, Pumping, Drawdown, *Florida, *Verna, Well fields.

Four test wells were drilled in the vicinity of the city of Sarasota well field near Verna, Fla., to provide hydrologic and geologic information. An expedient and economical method of air lifting water samples from isolated water-producing zones while drilling was utilized. Lithologic logs of drill cuttings and geophysical logs, including point resistance and spontaneous potential electric logs, gamma-ray logs, and caliper logs, were made. Chemical quality of water was determined for principal producing zones at each well. Dissolved solids from composite water samples ranged from 313 milligrams per liter in test well 0-1 north of the well field to 728 milligrams per liter in test well 0-3 within the well field. Each test well was pumped to determine maximum discharge, water-level drawdown, and recovery time. A leaking pump column on test well 0-1 prevented accurate measurement of drawdown on the well. Test well 0-2, located east of the well field, had a pumping rate of 376 gallons per minute and 13.11 feet of drawdown after 3 hours and 50 minutes; test well 0-3 had a maximum yield of 320 gallons per minute, a drawdown of 31.91 feet after 2 hours and 35 minutes of pumping, had a recovery time of 20 minutes; and test well 0-4, south of the well field, had a pumping rate of 200 gallons per minute with 63.34 feet of drawdown after 2 hours and 35 minutes. (USGS)
W82-00424

**PREDICTED EFFECTS ON GROUND WATER OF CONSTRUCTION OF DIVIDE CUT SECTION, TENNESSEE-TOMBIGBEE WATERWAY, NORTHEASTERN MISSISSIPPI USING A DIGITAL MODEL,**
Geological Survey, Jackson, MS. Water Resources Div.
M. S. McBride.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.00 in paper

copy, $3.50 in microfiche. Geological Survey Open-File Report 81-649, 1981. 50 p, 25 Fig, 1 Tab, 52 Ref.

Descriptors: *Groundwater, *Waterways, Navigation, *Drawdown, *Forecasting, Model studies, Simulation, Geology, Channeling, Artifical lakes, Dams, Groundwater movement, Wells, Water level, Drawdown, Hydrographs, *Mississippi, *Tennessee-Tombigbee Waterway, Tennessee River, Tombigbee River, *Canal construction.

The Tennessee-Tombigbee Waterway, connecting the Tennessee River in northeastern Mississippi with the Gulf of Mexico, is currently (1980) under construction. The Divide Section, the northernmost 39 miles of the Waterway, will consist, from north to south, of (1) a dredged channel, (2) the Divide Cut, and (3) an artifical lake impounded by the Bay Springs Dam. In all three, water will be at Tennessee River level. A three-dimensional digital model covering 3,273 square miles was constructed to simulate ground-water flow in the Gordo and Eutaw Formations and the Coffee Sand in the vicinity of the Divide Section. The model was calibrated to preconstruction water levels, then used to simulate the effects of stresses imposed by the construction of the Divide Section. The model indicates that the system stabilizes after major changes in conditions within a few months. The Divide Cut acts as a drain, lowering water levels as much as 55 feet. Drawdowns of 5 feet occur as much as 8 miles from the Cut. The 80-foot-high Bay Springs Dam raises ground-water levels by 5 feet as far as 6 miles from its impoundment. Drawdown is not likely to affect public water supplies significantly, but probably will adversely affect a relatively small number of private wells. (USGS)
W82-00428

## 2G. Water In Soils

**MODELING GRAIN SORGHUM RATOON CROPPING AND ASSOCIATED RUNOFF AND SEDIMENT LOSSES,**
Science and Education Administration, Temple, TX. Blackland Conservation Research Center.
D. L. Stinson, G. F. Arkin, T. A. Howell, C. W. Richardson, and J. R. Williams.
Transactions of the ASAE, Vol 24, No 3, p 631-635, 642, May/June, 1981. 6 Fig, 2 Tab, 7 Ref.

Descriptors: *Sorghum, *Mathematical models, *Crop yield, Runoff, Crop production, Sediments, Soil erosion, Water quality, Soil water, Growth, Agriculture, Ratoon cropping.

A practical method was developed to quantitatively describe the effects of ratoon cropping (producing a new crop without replanting) grain sorghum on water quality and quantity parameters and on crop growth and yield. Simulation was used to evaluate the effects of ratoon cropping grain sorghum on volume and sediment load of runoff water. Also, simulation was used to evaluate the effects on availability of soil moisture as it related to crop growth and yield. A growth crop model and a hydrologic model were combined. In only 9 of the 40 years simulated would a ratoon (second) crop have yielded 1500 kg/ha or more. Runoff, evapotranspiration, seepage, sediment yields, total crop yields, and plant crop yields for ratoon cropping were significantly different at the 5% level from those for single cropping for the 9 years with acceptable ratoon crops. The probability of producing a 1500 kg/ha ratoon grain crop yield starting with a fully recharged soil water profile at the plant (initial) crop harvest time was 70%. (Small-FRC)
W82-00113

**SOIL HYDRAULIC STABILITY IN A SUBSURFACE DRAINAGE SYSTEM,**
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
Z. A. Samani, and L. S. Willardson.
Transactions of the ASAE, Vol 24, No 3, p 666-669, May/June, 1981. 3 Fig, 2 Tab, 6 Ref.

Descriptors: *Hydraulic gradient, *Soil stability, *Soil saturation, Erosion, Drainage systems, Permeability coefficient, Plasticity, Mathematical equations, Estimating equations, Soil water.

An indirect way was developed to evaluate the hydraulic stability of saturated soils in the immediate vicinity of a subsurface drain. Six soils from Utah, one from Ohio, and five from Michigan were tested to identify their hydraulic failure gradients. Plasticity index and hydraulic conductivity were correlated with hydraulic failure. Thus, soil stability and density can be used to estimate the internal water flow gradient at which hydraulic failure of the soil structure will occur. An equation was developed which can be used to estimate the hydraulic failure of soils. An increase in soil density or compaction will increase the value of the gradient of hydraulic failure. Data on hydraulic failure can be used with drainage design information to determine whether a drain envelope is needed. It is also possible to calculate the thickness of the envelope or drain diameter. (Small-FRC)
W82-00115

**TRANSIENT SOIL MOISTURE MOVEMENT THROUGH LAYERED SOILS USING A FINITE ELEMENT APPROACH,**
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
R. Pall, A. R. Jarrett, and C. T. Morrow.
Transactions of the ASAE, Vol 24, No 3, p 678-683, May/June, 1981. 13 Fig, 1 Tab, 21 Ref.

Descriptors: *Mathematical models, *Fluid flow, *Soil water, Porous media, Flow, Mathematical studies, Finite element method, Darcys law, Soil environment, *Soil water movement.

A numerical model to study transient vertical moisture flow through homogeneous and layered soils under isothermal conditions was developed, which uses a finite element approach. The principles of Darcy law flow and mass balance were applied to each element of a flow system to obtain the soil moisture conditions at each time. The model gave results comparable to the numerical method of Hanks and Bowers (1962). One advantage of the new model is that it can be easily programmed. The model is efficient because it does not use the partial differential equation of unsaturated flow which saves computer time. There is physical meaning to the steps in computation because the physical laws of flow through porous media and mass conservation appear explicitly in the model. Unlike other models, the procedure is straight forward, flexible in application, and does not require complex algebraic manipulation. The model can handle both heterogeneous soil and non-uniform initial moisture conditions. (Small-FRC)
W82-00133

**AN INFILTRATION MODEL: DEVELOPMENT AND EVALUATION OF ITS PARAMETERS,**
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
B. N. Wilson, D. C. Slack, and C. L. Larson.
Transactions of the ASAE, Vol 24, No 3, p 670-677, 683, May/June, 1981. 7 Fig, 4 Tab, 21 Ref.

Descriptors: *Mathematical models, *Rainfall infiltration, *Ponding, *Soil water, Infiltration, Mathematical studies, Air-water interfaces, Porous media, Flow, Gravity flow.

An infiltration model, called ART, was developed which considers air viscous forces and models a Buckley-Leverett profile at ponding and subsequent infiltration events. It is based on a constant rainfall rate prior to surface ponding and on the assumption that the surface remains at field saturation for the remainder of the event. It also assumes a deep homogeneous soil profile at a uniform initial moisture content. Gravity and resistance flow components are evaluated by associating them with similar flow components in a modified Green-Ampt-Mein-Larson model. The model is efficient and uses less computer time than other approaches, and explicity demonstrates the physical laws of flow through porous media and mass conservation. The procedure is straight forward, flexible in application, and does not require complex algebraic manipulations. It was developed to handle both heterogeneous soil and non-uniform initial moisture conditions. (Small-FRC)
W82-00137

**A MORE VERSATILE SOIL WATER SAMPLER,**
North Central Forest Experimental Station, Grand Rapids, MN.
For primary bibliographic entry see Field 7B.
W82-00191

**VARIATION IN MICROBIAL ACTIVITY IN HISTOSOLS AND ITS RELATIONSHIP TO SOIL MOISTURE,**
Agricultural Research and Education Center, Belle Glade, FL.
R. L. Tate, III, and R. E. Terry.
Applied and Environmental Microbiology, Vol 40, No 2, p 313-317, August, 1980. 3 Fig, 5 Tab, 11 Ref.

Descriptors: *Microbial degradation, *Soil moisture, Organic soil, *Cropland, Sugarcane, Soil water, Dehydrogenase, Enzymes, Bacteria, Oxidation, Aerobic bacteria, Anaerobic conditions.

Dehydrogenase activity and microbial biomass were examined to further elucidate the factors limiting the oxidation of soil organic matter in drained, cultivated histosols. Biomass provided an indication of the overall variation in microbial populations, whereas dehydrogenase reflected the respiratory rate of the microbial community. The variation of these activities, aerobic carbon metabolism, and aerobic bacterial populations with soil moisture were studied to determine the effects of moisture on overall soil microbial activity and to elucidate the relationship between aerobic and anaerobic catabolism of soil organic matter in Pahokee muck. Dehydrogenase activity was 2- to 7-fold greater in soil cropped to St. Augustinegrass compared with uncropped soil. Biomass ranged from equivalence in the two soils to a 3-fold stimulation in the cropped soil. Biomass in soil cropped to sugarcane approximated that from the grass field, whereas dehydrogenase activities of the cane soil were nearly equivalent to those of the fallow soil. Microbial biomass, dehydrogenase activity, aerobic bacterial populations, and salicylate oxidation rates all correlated with soil moisture levels. These data suggest that within the moisture ranges detected in the surface soils, increased moisture stimulated microbial activity, whereas within the soil profile where moisture ranges reached saturation, increased moisture inhibited aerobic activities and stimulated anaerobic processes.
W82-00244

**A COMPARATIVE STUDY OF THREE FORMS OF THE RICHARD EQUATION USED FOR PREDICTING ONE-DIMENSIONAL INFILTRATION IN UNSATURATED SOIL,**
Universite Scientifique et Medicale de Grenoble (France). Inst. de Mecanique.
R. Haverkamp, and M. Vauclin.
Soil Science Society of America Journal, Vol 45, No 1, p 13-20, 1981. 9 Fig, 22 Ref.

Descriptors: *Mathematical equations, *Unsaturated flow, *Infiltration, Mathematical analysis, Mathematical models, Finite difference methods, *Soil water, Feasibility studies, Comparison studies.

The performance of three finite difference models, each of which is based on a different means of expressing the Richard transient water transfer equation, is compared with respect to precision, time consumption, and economic feasibility. The three models were tested on both a quasi-analytical solution and on experimental results for two different types of soil and for two upper boundary conditions (Dirichlet and Neumann). The best results were obtained with the Kirchhoff model, which was not affected by weighting problems. The model based on the local balance form of the Richard equation was slightly influenced by weighting errors, but was less time consuming than the model based on the Kirchhoff integral transfor-

mation. The model based on the nonconservative decomposed form of the Richard equation was highly influenced by weighting errors and gave the worst results. The range of operation of the decomposed model is also limited with respect to the choice of mesh ratios. The performances of the three models were independent of the chosen upper boundary condition. Nomograms can be evaluated for the three models, relating as a function of the chosen space and time step the performances of the models in terms of precision, amounts of water infiltrated, and computer time. These nomograms can help the user select the correct discretization scheme for the problem under consideration. Since the tests, which were conducted on two types of soil with totally different hydrodynamic properties, led to qualitatively identical results, it is reasonable to expect similar results on other types of soil. (Carroll-FRC)
W82-00328

**AREAL PREDICTIONS OF WATER AND SOLUTE FLUX IN THE UNSATURATED ZONE,**
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
For primary bibliographic entry see Field 6A.
W82-00381

**TWO-DIMENSIONAL LINEARIZED MOISTURE FLOW WITH WATER EXTRACTION,**
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 2I.
W82-00405

**EFFECTS OF TOPSOIL AND SUBSOIL THICKNESS ON SOIL WATER CONTENT AND CROP PRODUCTION ON A DISTURBED SOIL,**
Science and Education Administration, Mandan, ND. Northern Great Plains Research Center.
J. F. Power, F. M. Sandoval, R. E. Ries, and S. D. Merrill.
Soil Science Society of America Journal, Vol 45, No 1, p 124-129, 1981. 2 Fig, 7 Tab, 9 Ref.

Descriptors: *Soil water, *Crop production, *Soil profiles, Topsoil, Subsoil, Soil horizons, Land reclamation, Spoil banks, Mine wastes, Crop yields.

There is very little quantitative data on the effects of soil thickness upon crop production in semiarid regions. Soil thickness may affect plant rooting depth and the quantity of soil water available for plant growth. This will affect crop growth potentials, especially when the underlying material is a poor medium for plant root activity, as are sodic mine spoils. The research reported in this paper, which was conducted in connection with mined land reclamation research, involved reconstruction of soil by building a wedge ranging from 0 to 210 cm thick with productive subsoil on top of leveled sodic mine spoils derived from shale. This subsoil wedge was then covered with 0, 20, or 60 cm of topsoil. A fourth treatment involving mixing subsoil and topsoil within the wedge in a 3 to 1 ratio. Alfalfa, crested wheat grass, native grasses, and spring wheat were grown on the plots for five years. Yields of all crops increased as total soil thickness increased to the 90 to 150 cm range. All crops except wheat produced at least 90% of the maximum yield with at least 90 cm of mixed topsoil and subsoil spread over the spoils. Water was extracted from the upper 30 to 90 cm of spoils when the soil-spoil interface was within 90 cm of the soil surface. Thickness of the topsoil had no effect on depth of water extraction. Alfalfa extracted water to about 135 cm if sodic spoils were within 90 cm of the surface and to about 175 cm where spoils were covered with at least 150 cm of soil materials. Depth of water extraction under these two situations was about 120 and 150 cm, respectively, for crested wheatgrass, 80 and 120 cm for native grasses, and 75 and 90 cm for spring wheat. There was no evidence of any accumulation of soil water just above the soil-spoil interface under any situation. (Carroll-FRC)
W82-00465

**UNSATURATED WATER FLOW THROUGH A SIMULATED WHEEL TRACK,**
Science and Education Administration, Morris, MN.
D. C. Reicosky, W. B. Voorhees, and J. K. Radke.
Soil Science Society of America Journal, Vol 45, No 1, p 3-8, 1981. 10 Fig, 1 Tab, 14 Ref.

Descriptors: *Soil physical properties, *Flow characteristics, *Soil compaction, Soil water potential, Compaction, Tensiometers, Conductivity, Cropland, Hydraulic gradient, Soil moisture retention, Soil porosity, Plant growth.

Soil physical properties which affect plant growth can be altered by wheel-track compaction. This study investigated the effect of a simulated wheel track on water movement and soil matric potential distribution under laboratory conditions. The 2 millimeter fraction of the surface layer of a Barnes loam was packed into a soil container large enough to permit a 40-centimeter wide wheel track to be simulated midway between two plant rows spaced 75 centimeters apart. The simulated wheel track was imposed using a compaction tool attached to a penetrometer proving ring that compacted the soil in 25 square centimeter segments at a pressure of 3.25 kilograms per square centimeter. Miniature spring-loaded tensiometers installed at 5 centimeter grid spacings in the wall of the soil container were used to measure hydraulic head. Water content, bulk density, and penetrometer resistance were measured in experimental runs with soil packed wet and packed dry. The change in the pore size distribution that resulted from increased bulk density significantly affected water flow properties of the soil. There were marked reductions in both saturated and unsaturated conductivity with increase in soil bulk density. The water retention curves were also significantly altered by increasing the bulk density. Lower hydraulic heads and larger hydraulic gradients were found under simulated wheel-tracked compaction than under the non-wheel-tracked area. Two-dimensional plots of hydraulic head at selected times showed that isopotential lines curved around the wheel-tracked area. The data suggest that there is less water flow in the wheel track than in surrounding soil. (Carroll-FRC)
W82-00473

## 2H. Lakes

**EFFECTS OF MOUNT ST. HELENS ERUPTION ON SELECTED LAKES IN WASHINGTON,**
Geological Survey, Tacoma, WA. Water Resources Div.
N. P. Dion, and S. S. Embrey.
Available from the Branch of Distr., USGS, 604 Pickett St. Alexandria, VA 22304. Geological Survey Circular 850-G, 1981. 25 p, 11 Fig, 10 Tab, 11 Ref.

Descriptors: *Lakes, *Volcanoes, *Limnology, *Water quality, Chemical property, Physical property, Ecosystems, *Washington, *Mount St. Helens, Spirit Lake, St. Helens Lake, Fawn Lake, Venus Lake, Walupt Lake, Warden Lake, Sprague Lake, Amber Lake, *Volcanic ash.

The cataclysmic eruption of Mount St. Helens altered the physical, chemical, and biological characteristics of numerous Washington lakes. As would be expected, those lakes closest to the volcano were the ones affected most by the eruption. Spirit Lake can now be considered a completely different lake because of its higher altitude, larger area, shallower depth, and changed hydrology, biology, and water chemistry. Water-quality changes were observed only in the lakes situated in the blast zone of the volcano. The changes included increases in most chemical constituents and reductions in transparency. Productivity levels in these lakes, as estimated by chlorophyll a concentrations, probably increased. No chemical or biological changes were observed in lakes that received only ashfall. (USGS)
W82-00006

**PREDICTING LAKE LEVELS BY EXPONENTIAL SMOOTHING,**
Department of the Environment, Edmonton. Div. of Design and Construction.
For primary bibliographic entry see Field 2A.
W82-00118

**NITROGEN FIXATION AND THE NITROGEN BUDGET OF A EUTROPHIC IMPOUNDMENT,**
National Inst. for Water Research, Pretoria (South Africa).
P. J. Ashton.
Water Research, Vol 15, No 7, p 823-833, July, 1981. 12 Fig, 4 Tab, 29 Ref.

Descriptors: *Nitrogen fixation, *Reservoirs, *Eutrophication, Nutrients, Eutrophic lakes, Lakes, Phosphorus, Nitrification, Ammonification, Anabaena circinalis, Rietvlei Dam, *South Africa.

At Rietvlei Dam, South Africa, eutrophic and N-limited, three summer blooms (1975-77) of Anabaena circinalis produced between 1.1 and 24.5 tons of nitrogen by fixation. This represented 1.4%-46.5% of the total annual inflow of combined N. Soluble organic N is a major part of the N pool in the impoundment, and ammonification and nitrification produce large quantities of inorganic N from organic material. High water temperatures, low concentrations of combined N, and low flow promote the fixation process. The N:P ratios in the outflow show sharp peaks (4, 10, and 18) during summer algal blooms, whereas the inflow N:P ratios remain relatively constant throughout the year, about 1-2. (Cassar-FRC)
W82-00127

**ANAEROBIC METHANE OXIDATION: OCCURRENCE AND ECOLOGY,**
Wisconsin Univ.-Madison. Dept. of Bacteriology.
A. J. B. Zehnder, and T. D. Brock.
Applied and Environmental Microbiology, Vol 39, No 1, p 194-204, January, 1980. 8 Fig, 6 Tab, 33 Ref.

Descriptors: *Oxidation, *Methane, *Sediments, Sludge, *Anaerobic conditions, Lakes, Lake Mendota, Wastewater, Iron, Sulfates, Sulfides, Lake sediments, Mud, Wisconsin.

Freshwater sediments were taken from Lake Mendota, a hard-water eutrophic dimictic lake with a mud bottom. The water overlying the sediments is anoxic and contains hydrogen sulfide. The sediments actively produce methane during the entire year. Samples were taken in the deepest section of the lake with a water column depth of 23 meters. Anoxic sediments and digested sewage sludge anaerobically oxidized methane to carbon dioxide while producing methane. This strictly anaerobic process showed a temperature optimum between 25 and 37 degrees C, indicating an active microbial participation in this reaction. Methane oxidation in these anaerobic habitats was inhibited by oxygen. The rate of the oxidation followed the rate of methane production. The observed anoxic methane oxidation in Lake Mendota and digested sewage sludge was more sensitive to 2-bromoethanesulfonic acid than the simultaneous methane formation. Sulfate diminished methane formation as well as methane oxidation. However, in the presence of iron and sulfate the ratio of methane oxidized to methane formed increased markedly. Manganese dioxide and higher partial pressures of methane also stimulated the oxidation. The rate of methane oxidation in untreated samples was about two percent of the methane production rate in Lake Mendota sediments and eight percent of that in digested sludge. This percentage could be increased up to 90% in sludge in the presence of 10 mM ferrous sulfate and at a methane partial pressure of 20 atmospheres. (Baker-FRC)
W82-00218

**IMPACT OF CONSTRUCTION OF A HYDROELECTRIC PROJECT ON THE WATER QUALITY OF FIVE LAKES IN NOVA SCOTIA,**
Department of the Environment, Halifax (Nova Scotia).

For primary bibliographic entry see Field 5C.
W82-00227

**RESONATOR STUDIES FOR KINCARDINE HARBOUR, LAKE HURON,**
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 8B.
W82-00228

**ARE SIERRA LAKES BECOMING ACID,**
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5C.
W82-00231

**DISTRIBUTION AND TRANSPORT OF HEAVY METALS IN THE SEDIMENTS OF A SMALL NORTHERN EUTROPHIC LAKE,**
Alberta Environmental Center, Vegreville.
For primary bibliographic entry see Field 5B.
W82-00235

**EXPERIMENTAL STUDIES ON THE EFFECT OF ARSENIC ON MICROBIAL DEGRADATION OF ORGANIC MATTER AND ALGAL GROWTH,**
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
G. J. Brunskill, B. W. Graham, and J. W. M. Rudd.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 415-423, March, 1980. 7 Fig, 4 Tab, 41 Ref.

Descriptors: *Eutrophication, *Wastewater disposal, *Arsenic, Water pollution effects, Lakes, Nutrients, Phosphorus compounds, Nitrogen compounds, Phytoplankton, Algae, Organic matter, Bacteria, *Microbial degradation, Degradation, Particulate matter, Chemical reactions, Ontario.

The effects of arsenate and arsenite on microbial degradation of organic matter in lake water were studied in experimental tubes in Lake 303 at the Experimental Lakes Area, Northern Ontario. Results on this lake suggested that addition of domestic sewage to Kam Lake, Northwest Territories, containing 30-50 micromoles per liter of arsenic from gold mine tailing pond water, would restrain eutrophication. Summer degradation of organic matter was not inhibited by As, and dissolved P remained high, making more P available for outflow downstream. Arsenic depressed the rates of formation of particulate P and planktonic uptake of dissolved P. Summer blooms are not expected to be as extensive due to As inhibition of P uptake by the plankton. Under winter ice 40 micromoles per liter arsenate or arsenite inhibited microbial degradation by 50%. Under aerobic conditions, arsenite was oxidized at the rate of two micromoles per liter per day. Summer rates were similar. Under anaerobic conditions arsenate was reduced at the rate of one micromole per liter per day. (Cassar-FRC)
W82-00237

**SULFHYDROLASE ACTIVITY IN SEDIMENTS OF WINTERGREEN LAKE, KALAMAZOO COUNTY, MICHIGAN,**
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
G. M. King, and M. J. Klug.
Applied and Environmental Microbiology, Vol 39, No 5, p 950-956, May, 1980. 4 Fig, 3 Tab, 17 Ref.

Descriptors: Sediments, Lakes, *Sulfates, Enzymes, *Wintergreen Lake, *Michigan, Hypolimnion, Sulfides, Oxidation, *Lake sediments.

An initial characterization of the ester sulfate cycle in anoxic sediments of Wintergreen Lake, Michigan, is presented. Significant levels of sulfhydrolase activity were found in littoral, transition, and profundal sediment samples. Rates of sulfate formation suggest that the sulfhydrolase system would represent a major source of sulfate within these sediments. Sulfate formed by ester sulfate hydrolysis can support dissimilatory sulfate reduction as indicated by the incorporation of S-35 from labeled sodium dodecyl sulfate into S-35 labeled hydrogen sulfide. Sulfhydrolase activity varied with sediment depth, was greatest in the littoral zone, and was sensitive to the presence of oxygen. Estimations of ester sulfate concentrations in sediments revealed large quantities of ester sulfate. Both total sulfur and ester sulfate concentrations varied with the sediment type and were two to three orders of magnitude greater than the inorganic sulfur concentration. (Baker-FRC)
W82-00241

**COMPARISON OF IN SITU AND IN VITRO RATES OF METHANE RELEASE IN FRESHWATER SEDIMENTS,**
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
C. A. Kelly, and D. P. Chynoweth.
Applied and Environmental Microbiology, Vol 40, No 2, p 287-293, August, 1980. 2 Fig, 4 Tab, 26 Ref.

Descriptors: *Sediments, *Methane, Lakes, Microbial degradation, Natural waters, Seasonal variations, Lake sediments, Comparison studies.

A study was made of anaerobic lake sediment incubated in vitro for its ability to mimic natural in situ sediment activities, using rate of methane production for the comparison. Two lakes with different rates and seasonal patterns of methanogenic activity were compared. During the study 82 cores were taken and 200 individual sections were incubated. There was good agreement between rates of in situ methane release and initial rates of production measured in vitro in surface sediment. The evidence indicated that it is the in situ surface sediment methane production which is primarily responsible for maintaining in situ methane release, and thus the above agreement was what was expected if surface in situ activity was maintained in vitro. When deeper sediment was investigated, the sum of in vitro rates from 0 to 20 cm was much higher than in situ release rates and would have resulted in an impossibly high volume of gas. The extra gas could not have been stored within the sediments. It was concluded that the in situ methanogenic activity of the 0 to 3 cm anaerobic surface sediments could be preserved during removal and laboratory incubation. However, similar treatment of deeper sediment appeared to stimulate methanogenic activity. (Baker-FRC)
W82-00245

**FACTORS AFFECTING PHOSPHORUS RELEASE FROM INTACT LAKE SEDIMENT CORES,**
Wisconsin Univ.-Madison. Water Chemistry Lab.
G. C. Holdren, Jr., and D. E. Armstrong.
Environmental Science and Technology, Vol 14, No 1, p 79-87, January, 1980. 7 Fig, 6 Tab, 37 Ref.

Descriptors: *Sediments, *Phosphorus, *Lakes, *Lake sediments, Limnology, Lake morphology, Lake stages, Epilimnion, Temperature effects, Eutrophication, Wisconsin, Oxidation-reduction potential.

This investigation considered the effects of mixing, redox potential, temperature, bioturbation, and sediment type in lakes on phosphorus release. Since phosphorus release into anoxic hypolimnetic waters can be approximated by diffusion models, only epilimnetic sediments were investigated. Intact sediment cores from epilimnetic areas of four Wisconsin lakes were incubated in the laboratory to determine the effects of various environmental parameters on sediment phosphorus release. Bioturbation was found to have the greatest effect on phosphorus release rates. Raising the temperature or lowering oxygen concentrations in the overlying water also led to increased release rates, while suspension of sediment and lowering the temperature removed phosphorus from the water column. Sediment type affected the relative importance of differing incubation conditions, with redox potential having more effect on noncalcareous sediments and temperature having greater effect on calcareous sediments. The results indicate that epilimnetic sediments could contribute significant amounts of inorganic phosphorus to the overlying water in some lakes. (Baker-FRC)
W82-00251

**LIGNOCELLULOSE MINERALIZATION BY ARCTIC LAKE SEDIMENTS IN RESPONSE TO NUTRIENT MANIPULATION,**
Cincinnati Univ., OH. Dept. of Biological Sciences.
T. W. Federle, and J. R. Vestal.
Applied and Environmental Microbiology, Vol 40, No 1, p 32-39, July, 1980. 6 Fig, 2 Tab, 22 Ref.

Descriptors: *Mineralization, *Arctic zone, *Lake sediments, Lignocellulose, Decomposition, Decomposing organic matter, Deterioration, Degradation, *Nutrients, Nitrogen, Phosphorus, Cellulose, Lignin.

Mineralization of specifically labeled C-14-lignocelluloses by sediments from a remote arctic lake was examined with regard to nutrient concentration and other environmental factors. The mineralizations of the cellulose and lignin components of lignocellulose were found to respond differently to manipulation of nitrogen and phosphorus levels. This suggests that nutrient concentrations, in addition to the relative recalcitrance of the two compounds, may be important in explaining the increased proportion of lignin to cellulose in decomposing litter. Mineralization was measured by quantifying the amount of labeled carbon dioxide released from the substrates. Nitrogen, and to a greater degree, phosphorus additions enhanced the mineralization of white pine cellulose during the summer of 1978. Nitrogen and phosphorus together had no cumulative effect. During the summer of 1979 nitrogen or phosphorus alone had only a slight stimulatory effect on the mineralization of a sedge cellulose, but together they had a dramatic effect. These differences were attributed to yearly variations in the nutrient availability within the lake. (Baker-FRC)
W82-00270

**OCCURRENCE OF APHANOMYCES OVIDESTRUENS, A FUNGUS PARASITIC ON COPEPODS, IN TWO EUTROPHIC LAKES,**
Otago Univ., Dunedin (New Zealand). Dept. of Zoology.
C. W. Burns.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 1, p 23-29, 1980. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Trophic level, *Lakes, *Distribution patterns, Fungi, *Aquatic fungi, Eutrophication, Animal parasites, Parasitism, Predation, Copepods, Aquatic life, Animal diseases, Reproduction, Population dynamics, *Eutrophic lakes, *New Zealand.

The occurrence of Aphanomyces ovidestruens on a freshwater calanoid copepod, Boeckella dilatata Sars, from two lakes in New Zealand is reported. The location and form of the asexual zoospores, oogonia, antheridia, and infection hyphae of the fungus on B. dilatata demonstrated some differences from the description of Aphanomyces ovidestruens. The infection hyphae on B. dilatata did not swell distally into bulbous appressoria, but rather tapered, sometimes accompanied by small constrictions, before branching into fine hyphae in the eggs of the host. The oogonia and oospores were typically larger in the fungus on B. dilatata than in that of Diaptomus gracilis. The oogonial walls of A. ovidestruens on B. dilatata were usually conspicuously roughened, often to the extent of being ornamented with tubercles or spines up to 5 micrometers long. The incidence of infection in the populations of B. dilatata was different in the two lakes and varied throughout the study. (Baker-FRC)
W82-00304

**BIOLOGICAL CONSEQUENCES OF TREATING A LAKE WITH HYDROGEN PEROXIDE ON THE PLANKTON BIOCENOSIS (BIOLOGIQUES DU TRAITEMENT D'UN LAC AVEC DU PEROXYDE D'HYDROGENE SUR LA BIOCENOSE PLANCTONIQUE),**

Institut National de la Recherche Agronomique, Thonon-les-Bains (France).
G. Balvay.
Water Research, Vol 15, No 6, p 691-696, 1981. 2 Fig, 3 Tab, 8 Ref.

Descriptors: *Plankton, *Hydrogen peroxide, *Toxicity, Rotifers, Biomass, Chlorphyll a, Water treatment, *Dissolved oxygen, Oxidation, Lakes, Phytoplankton, Aquatic life, Ecological effects, Lake Morillon, *France.

In an effort to improve dissolved oxygen conditions in Lake Morillon, France (volume 11,800 cu meters), hydrogen peroxide was added in September 13, 1978--280 kg at 1.5 meters depth and 175 kg at 4 meters depth. There was a decrease in chlorophyll a, phytoplankton biomass, rotifers, and primary producers immediately after addition of the hydrogen peroxide. Recovery began within a week. It was concluded that use of hydrogen peroxide did not endanger the continuity of the plankton biocenosis. (Cassar-FRC)
W82-00305

**THE PREDICTION OF LACUSTRINE PHYTOPLANKTON DIVERSITY,**
McGill Univ., Montreal (Quebec). Dept. of Biology.
B. D. LaZerte, and S. Watson.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 5, p 524-534, May, 1981. 7 Fig, 4 Tab, 37 Ref.

Descriptors: *Phytoplankton, *Species diversity, *Biomass, Lakes, *Lake Memphremagog, Quebec, Algae, Species composition, *Taxonomy, Prediction, Sampling.

Lake Memphremagog, Quebec, was the site of a two year study performed to test the hypothesis that total phytoplankton biomass can predict phytoplankton community structure independent of its taxonomic composition. A range of diversity numbers, based on proportional biomass, was calculated for each of 133 samples. Biomass was a good predictor of species evenness (relative distribution of biomass) but not species richness (number of species present) provided that counts were rarefied to a fixed and ideally large size. The method is not applicable to under-ice communities and to the extremely low biomass communities immediately after ice-out. Species richness is mainly dependent on season and changes in taxonomic composition. (Cassar-FRC)
W82-00319

**HYDROCHEMISTRY OF A DOLOMITE KARST: THE BRUCE PENINSULA OF ONTARIO,**
Department of the Environment, Burlington (Ontario). Lands Directorate.
For primary bibliographic entry see Field 2K.
W82-00321

**ANALYSIS OF CAPACITY REQUIREMENTS FOR STORAGE RESERVOIRS: A CASE STUDY,**
Calgary Univ. (Alberta). Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W82-00341

**PREDICTION OF TOTAL PHOSPHORUS CONCENTRATIONS, CHLOROPHYLL A, AND SECCHI DEPTHS IN NATURAL AND ARTIFICIAL LAKES,**
Iowa State Univ., Ames. Dept. of Animal Ecology.
D. E. Canfield, Jr., and R. W. Bachmann.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 4, p 414-423, April, 1981. 4 Fig, 5 Tab, 27 Ref. OWRT-A-063-IA(2).

Descriptors: *Lakes, *Phosphorus compounds, *Prediction, Model studies, Nutrients, Chlorophyll a, Secchi disks, Algae, Transparency, Eutrophication, Sediments, Lake sediments, Sedimentation rates, Artificial lakes, Natural waters.

A model for predicting total phosphorus was developed and tested using data on 704 natural and artificial lakes. It estimates P concentrations over a wide range of lake types at a 95% confidence interval of 31-288% of the calculated total P concentration. Total P concentrations are predicted equally well in natural and artificial lakes, but predictions of algal density as measured by Secchi disc and chlorophyll a concentrations are more reliable for natural lakes than for artificial lakes. This may be a result of non-algal turbidity. This model should be applicable to most lakes within the temperature region of the U.S. and southern Canada except for lakes in closed basins or bays within lakes. (Cassar-FRC)
W82-00400

**POSTDEPOSITIONAL MOBILITY OF PHOSPHORUS IN LAKE SEDIMENTS,**
McGill University, Montreal (Quebec). Dept. of Biology.
R. Carignan, and R. J. Flett.
Limnology and Oceanography, Vol 26, No 2, p 361-366, March, 1981. 7 Fig, 25 Ref.

Descriptors: *Phosphorus, *Lake sediments, *Migration, Lakes, Sediments, Path of pollutants, Sedimentation, Nutrients, Lake Memphremagog, Quebec, Sediment-water interfaces, Deposition.

Phosphorus in sediments of Lake Memphremagog, Quebec, migrated upward and accumulated near the sediment-water interface in the 2-6 cm layer, as defined by constant Pb210 activity. In this layer, total phosphorus ranged from 2700 to 3300 micrograms per g, whereas the upper 2 cm contained about 2200 micrograms per g and the 7-18 cm layers 1300-1900 micrograms per g. In a 5-week experiment, homogenized sediment was placed in water in an aquarium with aeration and homogeneous mixing. Core samples showed that the total P concentration of the top 1 cm section was 1400 micrograms per g; the 1-2 cm layer was slightly depleted in P, 1100 micrograms per g; and the remainder of the column, 1200 micrograms per g. Interstitial P decreased to 0 at the surface from 1250-1350 micrograms per g in the rest of the profile. Soluble reactive P concentrations were fairly constant, near 200-300 micrograms per g throughout most of the profile, with a sudden increase in the top 1 cm and a slight decrease in the 1-2 cm layer. Iron concentrations behaved in a similar manner. This strongly suggests that upward P and Fe movements were induced by diffusion of interstitial P and Fe along a concentration gradient generated by precipitation in the oxidized surface layer of the sediments. Similar gradients were seen in nondisturbed sediments, indicating that this upward migration operates also under natural conditions. The remobilized P appears to be isotopically exchangeable (or mobile) under anaerobic conditions. Therefore, the total P levels in surface sediments have no relation to the currently sedimenting material, and P levels in the sediment layers may give a false historical P loading profile or P sedimentation rates. (Cassar-FRC)
W82-00474

**THE IMPORTANCE OF REGENERATED NITROGEN TO PHYTOPLANKTON PRODUCTIVITY IN A SUBALPINE LAKE,**
California Univ., Davis. Div. of Environmental Studies.
R. P. Axler, G. W. Redfield, and C. R. Goldman.
Ecology, Vol 62, No 2, p 345-354, April, 1981. 3 Fig, 4 Tab, 45 Ref.

Descriptors: *Nitrogen, *Phytoplankton, Mineralization, California, Alpine regions, Cold regions, Lakes, Nutrients.

The rate of ammonium regeneration due to zooplankton excretion and microbial mineralization processes were studied in relation to the rate of inorganic nitrogen assimilation by phytoplankton in epilimnetic water. The euphotic zone of dimictic, meso-oligotrophic Castle Lake is characterized by a rapid depletion of both nitrate and ammonium soon after spring thaw. External inputs of nitrogen are minimal during this period of time, and levels of inorganic nitrogen remain low until fall overturn. The rate of ammonium assimilation was high relative to nitrate assimilation, and was significantly correlated with the rate of ammonium regeneration. The importance of this rapid turnover of nitrogen to phytoplankton growth is consistent with the results of previous Castle Lake studies and with the current conceptual model of primary production in the mixed layer of nitrogen-deficient marine ecosystems. (Baker-FRC)
W82-00476

**SEASONAL PARTICLE-SIZE SELECTION BY DIAPTOMUS SICILIS IN OFFSHORE LAKE MICHIGAN,**
National Atmospheric and Oceanic Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
H. A. Vanderploeg.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 5, p 504-517, May, 1981. 3 Fig, 2 Tab, 52 Ref.

Descriptors: *Food habits, *Copepods, *Particle size, Lakes, Invertebrates, Aquatic animals, *Lake Michigan, Particle shape, Zooplankton, Diaptomus, Seston.

Diaptomus sicilis, a copepod abundant in the Laurentian Great Lakes, showed a relatively invariant pattern of particle-size selection in 23 separate feeding experiments conducted from spring through fall over a 2-year period. This pattern persisted for different feeding rates under varying conditions of particle-size spectrum shape, abundance and food quality of particles, and temperature. In one case, where the curve of filtering efficiency vs. particle size differed from the other curves, grazer-produced particles and/or elongated particles dominated the seston. The invariant selection is not inconsistent with both filtering and raptorial modes of feeding operating simultaneously. Evidence indicates that these organisms feed in a strong passive-mechanical filtering mode that may be supplemented by a raptorial mode that selects large particles of high food quality. (Cassar-FRC)
W82-00485

**REDUCTION OF SULFUR COMPOUNDS IN THE SEDIMENTS OF A EUTROPHIC LAKE BASIN,**
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
R. L. Smith, and M. J. Klug.
Applied and Environmental Microbiology, Vol 41, No 5, p 1230-1237, May, 1981. 8 Fig, 1 Tab, 22 Ref.

Descriptors: *Sulfur compounds, *Eutrophic lakes, *Lake sediments, Lakes, Sediments, Lake basins, Chemical reduction, Metabolism, Nutrients, Sulfur, Sulfates, Isotopic tracers.

The significance of sulfate reduction in sediments of inland waters, and especially of fresh water lakes, has not been as extensively characterized as that of marine systems. The distribution of natural sulfur substances ($SO_4^{2-}$, $H_2S$, S(0), acid-volatile sulfide, and total sulfur) in the sediments and overlying water column of a eutrophic fresh water lake and the occurrence of significant rates of sulfate reduction in this environment were investigated. Low concentrations of sulfate relative to those of acid-volatile sulfide and total sulfur and a decrease in total sulfur with sediment depth implied that the contribution of dissimilatory sulfur reduction to $H_2S$ production was relatively minor. Kinetic experiments with $^{35}S$ demonstrated an apparent Km of 0.068 mmol of $SO_4^{2-}$ reduced per liter of sediment per day. Tracer experiments with $^{35}S$ indicated an average turnover time of the sediment sulfate pool of 1.5 hours. A sediment depth profile to 15 centimeters demonstrated a total sulfate reduction of 15.3 mmol of sulfate reduced per square meter per day, corresponding to a mineralization of 30% of the particulate organic matter entering the sediment. Reduction of $^{35}S(0)$ occurred at a slower rate. Although these sediments contained low concentrations of oxidized inorganic compounds, the rates of sulfate reduction were high. These results indicate that this reduction can be

important in the anaerobic mineralization of organic carbon. (Carroll-FRC)
W82-00488

## 2I. Water In Plants

**MODELING GRAIN SORGHUM RATOON CROPPING AND ASSOCIATED RUNOFF AND SEDIMENT LOSSES,**
Science and Education Administration, Temple, TX. Blackland Conservation Research Center.
For primary bibliographic entry see Field 2G.
W82-00113

**SOYROOT - A DYNAMIC MODEL OF SOYBEAN ROOT GROWTH AND WATER UPTAKE,**
Punjab Agricultural Univ., Ludiana (India). Dept. of Soil and Water Engineering.
N. K. Narda, and R. B. Curry.
Transactions of the ASAE, Vol 24, No 3, p 651-656, 662, May/June, 1981. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Soybeans, *Mathematical models, *Growth, Growth rates, Roots, *Root development, *Moisture uptake, Soil-water-plant relationships, Carbohydrates.

SOYROOT, a dynamic model of soybean root growth, was developed from root growth attributes measured in laboratory and field studies, combined with simulated carbohydrate available for root growth. The model was based on evidence that root length provides a better correlation with water uptake by the plant root system than does root weight or number of roots. It consists of a root growth submodel and a macroscopic model of water uptake. Three simulation runs of the model were made using 1978 climatological data for Wooster, Ohio. The SOYMOD/OARDC model when coupled with the SOYROOT model responded to changes in soil moisture content predicted by the macroscopic model. The macroscopic model predicted soil moisture content reasonably well. The SOYROOT model is a first approximation and must be further reviewed and validated. (Small-FRC)
W82-00114

**PERFORMANCE OF BEARING CHERRY AND PRUNE TREES UNDER VERY LOW IRRIGATION RATES,**
S & E Irrigated Agriculture Research and Extension Center, Prosser, WA.
For primary bibliographic entry see Field 3F.
W82-00119

**EFFECT OF IRRIGATION AND TREE DENSITY ON PEACH PRODUCTION,**
Department of Agriculture, Harrow (Ontario).
R. E. C. Layne, C. S. Tan, and J. M. Fulton.
Journal of the American Society for Horticultural Science, Vol 106, No 2, p 151-156, March, 1981. 2 Fig, 2 Tab, 22 Ref.

Descriptors: *Crop yield, *Irrigation effects, *Peaches, Orchards, Plant growth, Fruit crops, Trees, Harrow, Ontario, Water stress.

Three irrigation regimes (no irrigation, 25% and 50% available soil moisture, ASM) and three tree planting densities (266, 358, and 536 trees per hectare) were studied in a peach (Prunus persica L. Batsch cv. Harken/Siberian C) orchard planted near Harrow, Ontario, in 1973. The 25% ASM plots were irrigated about four times yearly and the 50% plots, about 12 times per year. The best treatment was the highest tree density and 50% ASM, which increased fruit yields up to 99.5%. Irrigation at 50% ASM increased yields in the first five years of production up to 9.7%. No irrigation and the highest tree density increased yields up to 74.6%. Tree growth in irrigated plots was significantly greater than in unirrigated plots during the early years, 1974 and 1975, when the tree roots were near the surface. From 1976 to 1979 there was no significant difference. Tree growth was reduced by increasing tree density with the exception of 50% ASM and the highest tree density. Fruit size (proportion of marketable fruit) was increased by irrigation and little affected by tree density. There was no significant effect of irrigation or tree density on disease susceptibility or raw product fruit quality. (Cassar-FRC)
W82-00120

**EFFECTS OF SOIL WATER REGIME AND NITROGEN FORM ON BLOSSOM-END ROT, YIELD, WATER RELATIONS, AND ELEMENTAL COMPOSITION OF TOMATO,**
Missouri Univ., Columbia.
W. G. Pill, and V. N. Lambeth.
Journal of the American Society for Horticultural Science, Vol 105, No 5, p 730-734, September, 1980. 8 Tab, 29 Ref.

Descriptors: *Plants, *Water stress, Water demand, Nutrients, Calcium, Soil water, Potassium, Magnesium, Fertilization, *Nitrogen, *Soil-water-plant relationships, *Blossom-end rot.

A study was conducted to elucidate the interactive effects of soil water regime with NO3-N and NH4-N fertilization on blossom-end rot (BER) incidence and on plant ion concentrations and water stress. Seeds of Missouri breeding line 76-1-60-8 tomato, a relatively BER-susceptible line, were sown in vermiculite. Thirty-six 3-week-old seedlings were transplanted into individual 20 cm clay pots. Eight applications of NO3-N or NH4-N at 28 meq per pot were made at 5 day intervals. Under the two wettest soil water regimes, NH4-N compared to NO3-N fertilization reduced total and mean fruit number, whereas no difference was found under the driest regime. Incidence and severity of BER were increased by NH4 nutrition and by decreasing soil water potential. Decreasing soil water potential did not influence leaf Ca, Mg, or K concentrations, but it did decrease fruit concentration of these ions. At any soil water regime, NH4 fertilization decreased leaf Ca and Mg concentration, but generally increased leaf K and fruit Ca, Mg, and K concentrations. Since leaf diffusive resistance values increased with decreasing soil water potential, but were unaffected by N form, the lower overall transpiration and areal transpiration rates under NH4-N might be explained by increased non-leaf resistances to water flux and/or by reduced soil-plant water potential gradients. (Baker-FRC)
W82-00162

**ENVIRONMENTAL RESOURCES AND RESTRAINTS TO AGRICULTURAL PRODUCTION IN A MEDITERRANEAN-TYPE ENVIRONMENT,**
University of New England, Armidale (Australia). Dept. of Agronomy and Soil Science.
R. C. G. Smith, and H. C. Harris.
Plant and Soil, Vol 58, No 1-3, p 31-57, 1981. 17 Fig, 3 Tab, 37 Ref.

Descriptors: *Crop production, *Rainfall impact, *Soil water, Rainfall intensity, Rainfall rate, Precipitation, Agriculture, *Mediterranean, Semiarid climates, Arid climates, Soil-water-plant relationships, Crop yield, Model studies.

A dynamic model of a wheat crop was developed to analyze climatic data from a Mediterranean type environment in an effort to assess the relative importance of various environmental constraints. The environmental variables considered included day length, temperature, frost, solar radiation, wind, humidity, rainfall, and soil. This study used climatic data from a typical lowland site at Aleppo, Syria, where sowing generally is accomplished between mid-November and mid-December. The potential growing season, which is the time between the point at which continuous growth begins and the time it must cease because of the shortage of soil water, is determined by the interaction between climate, crop water use, and stored soil water. Annual rainfall during the growing season at Aleppo over a 14-year period varied from 113 millimeters to 453 millimeters and was positively correlated with potential growing season. Soil depth and texture are the major factors affecting the storage of water. The daily soil water balance for 12 years was simulated in order to analyze the variability of the distribution of soil water with depth and over time. Fallowing can be used to even out the availability of soil water from year to year. An evaluation of the crop water use and of the longer term effects of any increase in water use on the soil water carryover and variability of the system should be conducted prior to any change in the crops used in rotations. The ideal wheat variety for this climate would be one which would give modest yields in dry years but which would be yield-responsive in wetter years. (Carroll-FRC)
W82-00329

**EFFECTS OF WATER REGIME ON GROWTH, YIELD, AND NITROGEN UPTAKE OF RICE,**
International Rice Research Inst. Los Banos (Philippines).
C. S. Khind, and F. N. Ponnamperuma.
Plant and Soil, Vol 59, No 2, p 287-298, 1981. 6 Fig, 3 Tab, 14 Ref.

Descriptors: *Flood irrigation, *Rice, *Denitrification, Crop production, *Crop yield, *Wetlands, Nitrogen removal, Irrigation practices, Irrigation.

About 40% of the world's wetland rice area is rainfed and therefore is not assured of a water supply for continuous soil submergence, often resulting in alternate flooding and drying during the crop season. Since severe nitrogen losses through nitrification-denitrification are caused by alternate wetting and drying of soils, this process is believed to be an important pathway of nitrogen loss in rainfed wetland rice fields. A greenhouse experiment and two field experiments were conducted to investigate the effects of water regime on the performance of rice. The greenhouse experiment involved four water regimes (continuous flooding and soil drying for 16 days followed by reflooding, with drying beginning 2, 5, and 8 weeks after transplanting), four soils, and 0 and 100 milligrams of nitrogen per kilogram. The redox potentials of all soils were raised above the aerobic threshold by soil drying. While none of the soil drying regimes adversely affected soil high in nitrogen, adverse effects in the soil low in nitrogen were noted when soil drying occurred 2 and 5 weeks after transplanting. The field experiments tested the effects of three water regimes (continuous flooding, alternate drying and flooding every 2 weeks, and soil drying for 2 weeks at 6 weeks after transplanting followed by reflooding) and nitrogen concentrations of 1, 50, 100, and 150 kilograms per hectare on a nearly neutral clay soil during two growing seasons. None of the soil drying treatments resulted in decreased growth, yield, or nitrogen uptake by rice at any level of nitrogen in either growing season. Denitrification was not possible on reflooding since nitrate was absent after soil drying. These results indicate that loss of nitrogen due to alternate flooding and drying of soils carrying an established rice crop may not be appreciable, especially if the soil is high in nitrogen. (Carroll-FRC)
W82-00330

**A MODEL OF NATURAL AND MAN-INDUCED CHANGES IN OPEN FRESHWATER WETLANDS ON THE MASSACHUSETTS COASTAL PLAIN,**
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
J. S. Larson, A. J. Mueller, and W. P. MacConnell.
Journal of Applied Ecology, Vol 17, No 3, p 667-673, December, 1980. 1 Fig, 2 Tab, 10 Ref. OWRT-A-121-MASS.(2), 14-34-0001-9023.

Descriptors: *Wetlands, *Succession, *Vegetation, Marshes, Water policy, *Massachusetts, Bogs, Freshwater marshes, Agriculture, Shallow water, Construction, Road construction, Aquatic plants, Land use, Bristol, Environmental effects.

Aerial photography and cover maps were used to measure changes in open freshwater wetlands (not including wooded wetlands) in Bristol, Massachusetts, between 1951 and 1971. Nearly half of the 3958.9 hectare area showed changes in vegetation class. Over 900 hectares of wetlands were lost during the 20-year period. Natural succession pro-

duced more changes in vegetation (1485.2 hectares) than man-induced causes (total 560.0 hectares). Agriculture (82.9 hectares), cranberry culture (82.9 hectares), highway construction (84.5 hectares), and reservoirs and impoundments (103.1 hectares) were the leading man-induced causes of wetland changes. Although northeast U.S. wetlands are considered relatively stable, this data suggests a dynamic process. The main sequence moves from open water, through vegetated open water, deep marsh, shallow marsh, shrub swamp, to wooded wetland. Branches from this main sequence include dead woody deep marsh, cranberry bog, seasonally flooded flat, and meadow. (Cassar-FRC)
W82-00397

**TWO-DIMENSIONAL LINEARIZED MOISTURE FLOW WITH WATER EXTRACTION,**
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
A. W. Warrick, and D. O. Lomen.
Journal of Hydrology, Vol 49, No 3/4, p 235-246, 1981. 4 Fig, 12 Ref. OWRT-B-064-ARIZ(6).

Descriptors: *Moisture, *Sinks, Flow velocity, Fluctuations, Plant water potential, Hydrology, Soil-water-plant relationships, Soil water.

Analytical solutions for two-dimensional sources are presented, with the flow into the system balanced by space-distributed sink functions and flow out from the boundaries. The generalized solutions are presented for three types of surface boundary conditions: specified flux, specified matrix flux potential and flux proportional to the matrix flux potential. The first case is appropriate for trickle irrigation, the second for specified surface moisture or pressure head conditions, and the last analogous to evaporative conditions. Additional sub-surface line-sources can be combined with any of these solutions. The specific numerical results obtained all show similarities to line-sources of the same net strength, suggesting that a good first approximation can be found by assuming a source only equal to the net addition of water. The maximum error due to the approximation would be in the region close to the source, with the error damped out over relatively short distances. (Baker-FRC)
W82-00405

**EFFECTS OF TOPSOIL AND SUBSOIL THICKNESS ON SOIL WATER CONTENT AND CROP PRODUCTION ON A DISTURBED SOIL,**
Science and Education Administration, Mandan, ND. Northern Great Plains Research Center.
For primary bibliographic entry see Field 2G.
W82-00465

**SODIUM-POTASSIUM RATIOS IN SOIL SOLUTION AND PLANT RESPONSE UNDER SALINE CONDITIONS,**
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3C.
W82-00469

**VEGETATION AND NUTRIENT STATUS OF NORTHERN MICHIGAN BOGS AND CONIFER SWAMPS WITH A COMPARISON TO FENS,**
Michigan Univ., Pellston. Biological Station.
C. R. Schwintzer.
Canadian Journal of Botany, Vol 59, No 5, p 842-853, May, 1981. 5 Tab, 53 Ref.

Descriptors: *Bogs, *Fens, *Swamps, Peat bogs, *Nutrients, Wetlands, Vegetation, Succession, Hydrogen ion concentration, Water chemistry, Classification, *Michigan.

Information was obtained about the vegetation and telluric nutrient status of bogs and conifer swamps, comparable to that already available for fens. Also, bogs, fens, and conifer swamps were compared with respect to these features. The six bogs studied were characterized by well-developed field and bryophyte layers and strongly acid waters with very low Ca and Mg. The most prevalent plants were Chamaedaphne calyculata and Carex oligosperma of the field-layer plants and Sphagnum of the bryophyte layer. The four conifer swamps studied were characterized by well-developed tree and field layers and circumneutral waters of pH 7 to 7.4 with moderate to high Ca, Mg and alkalinity. The tree layer was dominated by Thuja occidentalis, while the most prevalent field plants were Mitella nuda, Abies balsamea, and Maianthemum canadense. Bogs, conifer swamps, and fens were related successionally but had different floristics, species density, proportion of evergreen species, role of symbiotic nitrogen fixing species, role of Sphagnum, and water chemistry. Bogs can be differentiated from conifer swamps and fens on the basis of nutrient status, which is dependent upon the degree of telluric water influence in rooting zones. Thus, these three types of wetlands should not be lumped together in the general category of bogs but should be considered separately. (Small-FRC)
W82-00484

## 2J. Erosion and Sedimentation

**EROSION AND SEDIMENTATION IN THE KENAI RIVER, ALASKA,**
Geological Survey, Laguna Niguel, CA. Water Resources Div.
K. M. Scott.
Geological Survey Open-File Report 81-219, 1981. 116 p, 19 Fig, 5 Tab, 53 Ref.

Descriptors: *Streams, *Channel erosion, *Bank erosion, *Sedimentation, Watersheds, Flow characteristics, Snowmelt, Floods, Bed load, Gravel, Vegetation effects, Fisheries, Salmon, Hydrographs, Aerial photography, *Alaska, *Kenai River.

The Kenai River is the most important freshwater fishery in Alaska. The flow regime is characterized by high summer flow of glacial meltwater and periodic flooding caused by sudden releases of glacier-dammed lakes in the headwaters. Every part of the stream is a known or potential salmon-spawning site. The stream channel is underfit, attributed to regional glacial recession and drainage changes, and locally is entrenched in response to geologically recent changes in base level. Throughout the central section of the river the channel is armored, a condition with implications for the ability of this section of channel to support the spawning and rearing of salmon. The entrenched section of the channel has been stable since 1951. Bank erosion is active both upstream and downstream from the entrenched channel, however. Although erosion rates have been generally constant since 1951, evidence suggests a possible recent decrease in bank stability that may be related to changes in river use. As population and recreation use increases, development can pose a hazard to the productivity of the stream through increased suspended-sediment concentration resulting directly from construction and, with greater potential for long-term impact, indirectly from bank erosion. A short-term hazard to both stream and developments is the cutoff of meander loops, the risk of which is increased by canals and boat slips cut in the surface layer of cohesive, erosion-resistant sediment on the flood plain within nonentrenched meander loops. A long-term hazard is an increase in bank erosion rates resulting from loss of vegetation on the high (up to 70 feet) cutbanks of entrenched and partially entrenched sections. (USGS)
W82-00015

**DEPOSITION OF RIVERBORNE ORGANIC CARBON IN FLOODPLAIN WETLANDS AND DELTAS,**
Oak Ridge National Lab., TN. Environmental Sciences Div.
P. J. Mulholland.
Available from the National Technical Information Service, Springfield, VA as CONF-8009140, Price codes: A18 in paper copy, A01 in microfiche. In: Flux of Organic Carbon by Rivers to the Oceans, Report of a Workshop, Woods Hole, MA, Sept 21-25, 1980, Dept. of Energy Report CONF-8009140, April 1981. p 142-172, 3 Fig, 2 Tab, 32 Ref.

Descriptors: *Organic carbon, *Flood plains, *Sediment distribution, *Deposition, Sedimentation, *Wetlands, Deltas, Sediment transport, Oxidation, Particulate matter, Reservoirs, Drainage, Channeling.

Interaction between rivers and floodplain wetlands generally results in a net annual deposition of riverborne sediment and particulate organic carbon of up to 100 g C per sq m over large wetland areas. Some of this material is certainly oxidized, but a large part of it probably escapes complete oxidation because of the lack of available oxygen. Global deposition of riverborne organic carbon in floodplain wetlands is at least 6% of total river flux, and probably higher. Some of man's activities, such as channelization and wetland drainage, are reducing the total area of floodplain wetland receiving river inputs. However, this reduction may be offset by increased erosion and subsequent floodplain deposition of organic carbon in less-developed regions. Increased construction of impoundments is increasing deposition and preservation of organic carbon in inland sediments. Land disturbance and agriculture increase soil erosion and result in large amounts of sediment deposition in the channels and floodplains of smaller streams and rivers. Assuming that the rates of formation of the world's major river deltas have been uniform over the past 12,000 years, organic carbon accumulation in these systems has been about 0.6 X 10 to the 15th power gC/yr. (Moore-SRC)
W82-00034

**PHYSICAL EFFECTS OF VEHICULAR DISTURBANCES ON ARID LANDSCAPES,**
Stanford Univ., CA. Dept. of Applied Earth Sciences.
For primary bibliographic entry see Field 4C.
W82-00111

**SOIL HYDRAULIC STABILITY IN A SUBSURFACE DRAINAGE SYSTEM,**
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 2G.
W82-00115

**SECONDARY FLOW, SHEAR STRESS AND SEDIMENT TRANSPORT,**
Pittsburgh Univ., PA. Dept. of Civil Engineering.
C-L. Chiu, and D. E. Hsiung.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY7, p 879-898, July, 1981. 9 Fig, 8 Ref.

Descriptors: *Open channel flow, *Shear stress, *Sediment transport, Model studies, Channel flow, Flow characteristics, Flow velocity, Flow pattern, Water conveyance, Alluvial channels.

Explicit links were established among interacting variables in open channel flows, such as the distribution of primary flow velocity, channel cross section, discharge rate, secondary flow, shear stress distribution, and sediment concentration. Data from the Rio Grande Conveyance, Bernardo, New Mexico, were used in the development of the relationships. A shear formula calculates the shear stress in the flow and along the bottom and side walls of alluvial channels. The geometric shape of boundary shear distribution computed along the channel bottom was similar to that of measured channel bottom, indicating a direct correlation between the boundary shear and the scour on the channel bed. The secondary flow affects sediment transport directly (convection) and indirectly (diffusion). The main parts of the mechanism governing sediment concentration are gravity, diffusion, and secondary flow. (Cassar-FRC)
W82-00117

**SEDIMENT AND NUTRIENT MOVEMENT FROM THE BLACK CREEK WATERSHED,**
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W82-00135

### ERODIBILITY OF STREAMBANK MATERIALS OF LOW COHESION,

Science and Education Administration, Oxford, MS. Sedimentation Lab.
E. H. Grissinger, W. C. Little, and J. B. Murphey.
Transactions of the ASAE, Vol 24, No 3, p 624-630, May/June, 1981. 6 Fig, 2 Tab, 9 Ref.

Descriptors: *Stream banks, *Soil erosion, *Cohesion, Soil types, Clays, Erosion, Wetting, Shear stress, Erosion rates, Particle size, Flumes.

The stability of fine grained streambank materials was evaluated for materials with plasticity index values of less than 15. Erosion rates of undisturbed channel bank materials were determined in the field with a portable flume. Measured erosion rates were sizable, and two erosive forces were identified. Excessive erosion occurred in samples that were relatively dry before testing, probably as a result of the detaching effect of wetting. Erosion in wet samples was dependent upon bed shear stress. Clay content was correlated significantly with the shear stress-dependent erosion rates, while maximum noneroding pinhole velocities correlated significantly with the same erosion rates for samples that had no limiting morphological characteristics. The significance of sample morphology was scale dependent and varied with the size of the test sample in relation to the size of the morphological components. (Small-FRC)
W82-00136

### EFFECT OF CROP RESIDUE ON SOIL LOSS FROM CONTINUOUS ROW CROPPING,

Science and Education Administration, Ames, IA. Agriculture and Home Economics Experimental Station.
J. M. Laflen, and T. S. Colvin.
Transactions of the ASAE, Vol 24, No 3, p 605-609, May/June, 1981. 3 Fig, 3 Tab, 13 Ref.

Descriptors: *Soil erosion, *Crop production, *Cultivated lands, Agriculture, Farms, Soil types, Slopes, Rainfall simulators, *Experimental farms.

Relative soil losses as affected by crop residue were evaluated using a rainfall simulator for several combinations of crop rotations, tillage systems, and canopy levels at two Iowa locations. Tillage treatments were conventional, reduced, and no-till, and the statistical design was a randomized complete block with two replicates. Crop canopy, kind of residue, and crop rotations had little effect on derived mulch factor-crop residue relationships, though this relationship was different at the two sites. The locational differences were apparently due to differences in slopes and/or soils. They can be explained on the basis of sediment transport, sedimentation theory, and size distributions of eroded material. Thus, presently used soil erosion prediction methods for conservation tillage systems could be improved by including the interaction effects of crop residue, soil, and slope. (Small-FRC)
W82-00145

### SEDIMENT TRANSPORT IN NORTON SOUND, ALASKA,

Geological Survey, Menlo Park, CA.
D. E. Drake, D. A. Cacchione, R. D. Muench, and C. H. Nelson.
Marine Geology, Vol 36, No 1/2, p 97-126, May, 1980. 16 Fig, 1 Tab, 20 Ref.

Descriptors: *Sediment transport, *Sounds, Tractive forces, Bays, Bights, *Yukon River, Rivers, Sand, Silt, Sediments, Silting, Norton Sound, *Alaska.

Temporal variations were monitored in bottom currents, pressure, and suspended matter concentrations within the major transport pathway of Yukon River suspended matter. The most significant transport occurs within advective currents flowing north across the outer part of the sound. The thickest accumulations of modern Yukon silt and very fine sand occur beneath this persistent current. Monitoring took place for 80 days during the summer of 1977 using a Geological Processes Bottom Environmental tripod system. Two distinctive periods of bottom flow and sediment transport were noted: an initial 59 days of fair-weather conditions, characterized by tidally dominated currents and relatively low, stable suspended-matter conditions; and a 21 day period during which several storms traversed the Northern Bering Sea, mean suspended-matter concentrations near the bottom increased by a factor of five, and the earlier tidal dominance was overshadowed by wind-driven and oscillatory wave-generated currents. Friction velocities at the monitoring site were generally subcritical during the fair-weather period. The data suggest that very fine sand constituting about 50% of the sediment on the outer part of the Yukon prodelta is transported during a few late-summer and fall storms each year. Suspended-matter transport during the storms in September 1977 was equal to four months of fair-weather transport. (Baker-FRC)
W82-00151

### ESTIMATING THE PHYSICAL CARRYING CAPACITY OF RECREATION AREAS: A RATIONALE FOR APPLICATION OF THE UNIVERSAL SOIL LOSS EQUATION,

Maryland Univ., College Park. Dept. of Recreation.
F. R. Kuss, and J. M. Morgan, III.
Journal of Soil and Water Conservation, Vol 35, No 2, p 87-89, March/April, 1980. 2 Tab, 21 Ref.

Descriptors: *Recreation facilities, *Soil management, Vegetation, Planning, Erosion, Soil conservation, Universal Soil Loss Equation, Land use, Soil erosion.

The Universal Soil Loss Equation was used to predict the physical carrying capacity of recreational areas. The soil loss tolerance factor (T) was substituted for the average annual soil loss per unit area (A). T represents the maximum rate of soil erosion that will permit the land's productivity to be sustained. Thus, T divided by the soil loss index becomes the maximum value of C (the vegetative cover and management factor) that an area can tolerate. Three picnic sites in the Patapsco Valley State Park, Maryland, were examined using the equation. The C values for the 3 sites were 0.009, 0.019, and 0.043, indicating that the first was a relatively sensitive area and should be zoned for limited use or scheduled for additional maintenance. Site 3 was relatively tolerant of recreational use. (Cassar-FRC)
W82-00274

### SOLAR CYCLES AND EROSIONAL EVENTS ON THE NEW SOUTH WALES CENTRAL AND SOUTH COASTS,

Sydney Univ. (Australia).
B. Stevenson.
Search, Vol 11, No 4, p 117-118, April, 1980. 2 Fig, 12 Ref.

Descriptors: *Beach erosion, *Sunspots, *Weather patterns, Solar radiation, Erosion, Jetstreams, *New South Wales, Australia, Storms, Coasts.

Erosional events on Australia's New South Wales coast were related to periods of low sunspot activity in 1857, 1876, 1889, 1912, 1944-45, 1966-67, and 1974-75. A high pressure anomaly occurs in the southern Tasman region during July at the sunspot minima and ascending phase of the sunspot cycle. This condition represents enhanced blocking with a resulting increase in storm activity and coastal erosion. A likely intermediate agent is variation in jetstream activity over the east Australian continent, weaker jetstreams being associated with low sunspot activity. (Cassar-FRC)
W82-00318

### RAINFALL INTENSITY-KINETIC ENERGY RELATIONSHIPS FOR SOIL LOSS PREDICTION,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Inst. of Earth Resources.
P. I. A. Kinnell.
Soil Science Society of America Journal, Vol 45, No 1, p 153-155, 1981. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Soil erosion, *Rainfall intensity, *Mathematical equations, Prediction, Erosion, Rainfall impact, Kinetic energy, Mathematical studies.

Soil erosion involves an expenditure of energy to detach soil material from the soil surface and to transport this detached material away from the eroding area. The kinetic energy expended by raindrops impacting with the soil surface accounts for a proportion of the energy required in the rainfall erosion process. Since the calculation of rainfall kinetic energies from drop-size data has demonstrated a high correlation between the rate of expenditure of rainfall kinetic energy and rainfall intensity when raindrops are traveling at or close to their terminal velocities, this relationship provides a means for the estimation of variations in rainfall kinetic energy in time and space. Application of three equations used to describe rainfall intensity-kinetic energy relations to data for Miami, Florida, and Zimbabwe (Rhodesia) demonstrated the limitations of these equations. The relationships between kinetic energy per unit quantity of rain (E sub RA) and rainfall intensity (I) at these two locations are best expressed by the equation E sub RA equals z (1 minus pe(-hI), where e is the base of natural logarithms and z, p, and h are empirical constants. It is suggested that this equation may provide the means by which reasonable estimates of rainfall kinetic energy can be derived in other geographic areas. (Carroll-FRC)
W82-00466

### EFFECT OF MULCH RATE ON SOIL LOSS BY RAINDROP SPLASH,

California Univ., Davis. Dept. of Land, Air, and Water Resources.
M. J. Singer, Y. Matsuda, and J. Blackard.
Soil Science Society of America Journal, Vol 45, No 1, p 107-110, 1981. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Soil erosion, *Mulching, *Rain, Erosion control, Erosion, Rills, Rainfall simulators, Mathematical studies, Kinetic energy, Rain splash, Sediment transport.

Previous studies by the present authors had investigated the relationship between percent cover by oat straw, blue oak leaves, and redwood litter and soil loss under simulated rainfall. A likely explanation for the finding of a parabolic relationship rather than the expected linear relationship is the lack of splash measurements as part of the experiment. A total of 50 rainfall simulator events of 76 millimeters per hour intensity for 30 minutes were run to investigate the effect of oat straw on splash detachment and transport of soil. Soil available for transport by interrill flow is a function of soil detached by interrill flow, direct splash impact, and secondary splash impact. Soil transported by interrill flow and soil transported by rain splash were measured separately. Increases in straw mulch rate resulted in significant decreases in both soil transported by rain splash and soil transported by interrill flow. When straw mulch cover reached 96%, rain splash sediment transport was reduced to less than 8% of the bare soil rain splash transport and interrill flow transport was reduced to 24% of the bare soil rain-flow transport amount. Since there was no reduction in the interril flow, the reduction in interrill flow transport was entirely due to a reduction in raindrop splash detachment. A linear correlation was found between cover level and sediment transport by rain splash and interrill flow when both processes were considered. The effectiveness of cover as an erosion control technique results from reductions in both direct rain splash detachment and indirect rain splash effects. (Carroll-FRC)
W82-00468

### EFFECTS OF SMALL AMOUNTS OF RESIDUE ON FURROW EROSION,

Science and Education Administration, Prosser, WA.
J. S. Aarstad, and D. E. Miller.
Soil Science Society of America Journal, Vol 45, No 1, p 116-118, 1981. 4 Tab, 9 Ref.

Descriptors: *Erosion control, *Soil erosion, *Organic matter, Erosion, Decomposing organic

matter, Turbidity, Agricultural runoff, Irrigation ditches, Sedimentation, Runoff, Furrow drainage.

Previous studies have demonstrated that preserving residue through reduced tillage may effectively control furrow erosion from irrigation. However, some tillage is desirable to incorporate fertilizers and herbicides and to prepare the seedbed. Since tillage destroys plant residues, this study was designed to determine whether or not small amounts of plant residue placed in irrigation furrows would decrease furrow erosion to tolerable levels. Studies conducted on a medium-textured soil with a 3% slope demonstrated that even the lowest residue rate, which consisted of a clump of straw placed every 2 meters down the furrow and was equivalent to about 60 kilograms per hectare on a total area basis, greatly reduced the sediment in and the turbidity of the runoff water. When 2.2 metric tons of straw per hectare was placed along the furrow, equivalent to about 0.4 metric tons per hectare on a total area basis, virtually all erosion was eliminated. Infiltration rates generally increased as the amount of residue in the furrow increased, causing a decrease in runoff velocity and sediment suspension. The highest residue rate reduced the turbidities of runoff water to less than those of the inflow water. These results indicate that limited tillage for herbicide incorporation and seedbed preparation can be performed while still leaving enough surface residue to control erosion. However, techniques and equipment for manipulation and placement of the residue after limited tillage need to be developed. (Carroll-FRC)
W82-00470

**THE EFFECTS OF SURFACE SLATY FRAGMENTS ON SOIL EROSION BY WATER,**
Southern Piedmont Conservation Research Center, Watkinsville, GA.
J. E. Box, Jr.
Soil Science Society of America Journal, Vol 45, No 1, p 111-116, 1981. 9 Fig, 5 Tab, 12 Ref.

Descriptors: *Surface runoff, *Soil erosion, *Soil properties, Rainfall, Slate, Erosion, Runoff, Rocks, Rainstorms, Mathematical studies, Mathematical equations, Soil types, Rainfall-runoff relationships, Mulching, *Slate Belt, *Southern Piedmont.

The Carolina Slate Belt, which extends from southern Virginia across the Carolinas and into Georgia, has shallow slaty soils in which slaty fragments make up between 5 and 40% of the surface soil weight. The effects of various amounts of slaty fragments on the surface on soil erosion and runoff were studied using Golston very slaty silt loam, Badin slaty silt loam, Georgeville silty clay loam, and a Georgeville loam. A rainulator was used to measure erosion and runoff from a 120-minute storm of 6.35 centimeters per hour. Photographs were used to determine the percent soil surface coverage by slaty fragments after each storm, which was found to range from 2.5 to 97%. Lots on which the soil had been sieved experienced soil loss rates which were about three to six times greater than the loss rates on natural plots. Doubling of the slaty fragments in the top 15 centimeters caused a soil loss rate lower than that of either the natural or the sieved plots. The relationship between soil loss ratio and percent coverage by slaty fragments was identical to that previously determined for plant residue mulching effects on soil loss ratio. An interim solution for predicting erosion on Slate Belt soils of the southern Piedmont which are subject to armoring by slaty fragments is proposed for use until sufficient data are available to adjust the K sub m factor or to add an armoring factor to the universal soil loss equation (USLE). Results from this study indicate that it may be possible to determine surface armoring after 30 minutes of intensive rainfall. (Carroll-FRC)
W82-00471

**GULLY DEVELOPMENT IN THE DEEP LOESS HILLS REGION OF CENTRAL MISSOURI,**
Missouri Univ., Columbia.
G. Roloff, J. M. Bradford, and C. L. Scrivner.
Soil Science Society of America Journal, Vol 45, No 1, p 119-123, 1981. 5 Fig, 3 Tab, 24 Ref.

Descriptors: *Gully erosion, *Loess, *Missouri, Soil strength, Soil erosion, Erosion, Overland flow, Slope stability, Geomorphology, Gullies, Stratigraphy, Soil properties.

Gullying is a frequent erosion phenomenon in the deep loess hills region of central Missouri, causing degradation of valuable farmland and increased sediment loadings in local streams. This study involved instrumentation of a small gully in a headslope position in loess over glacial till designed to monitor the downslope flow of water within the soil profile (throughflow) and sampling to identify soil properties related to the process of gully development. Throughflow was found to be controlled by the buried paleosol surface in this upper landscape position. The convergence of throughflow to the gully lower headwall was the predominant factor in lessening soil strength and in precipitating gully failure events. Although the exact mechanics of the failure events are not clear, failure planes follow cleavage planes within the soil mass caused by freezing-thawing and wetting-drying cycles. These cycles reduce soil stability by providing a greater number of cleavage planes. Failure debris is deposited against the gully wall, increasing gully stability. Overland flow was responsible for the removal of failure debris but not for bank erosion. Gully development at upper landscape positions such as this is very slow and probably depends on infrequent but intense rainfall events which carry the failure debris downstream and permit new failures. (Carroll-FRC)
W82-00472

## 2K. Chemical Processes

**EFFECT OF CATIONS ON COPPER ADSORPTION BY KAOLIN,**
Maryland Univ. Eastern Shore, Princess Anne. Dept. of Natural Sciences.
G. C. Gupta, and F. L. Harrison.
Water, Air, and Soil Pollution, Vol 15, No 3, p 323-327, April, 1981. 2 Fig, 15 Ref.

Descriptors: *Copper, *Adsorption, Estuarine environment, Metals, Heavy metals, Calcium, Cations, Magnesium, Ions, Rivers, Kaolinite, Soil types, Desorption, Path of pollutants, Clay, *Kaolin.

The effect of cations on the adsorption of copper by kaolin was studied in pure systems. Kaolin powder was sieved to obtain the less than 62 micrometer fraction, treated with hydrogen peroxide to remove organic material, and equilibrated overnight with 0.5N HCl. After further treatment a dilute suspension of H-kaolin was added to clay to obtain a final concentration of 27 ppm in each of several test bottles. To each test bottle either calcium chloride or magnesium chloride was added to give a final concentration of 20, 40, 100, 200 mg/liter and distilled water to give a final volume of 10 ml. The samples were then spiked with high activity radioactive copper-64. After filtration the amounts of radioactivity on the filter and in the filtrate were measured separately, using a gamma ray well counter. Copper adsorption was plotted against calcium or magnesium concentrations. No appreciable change was noted in the distribution coefficient of adsorption in clay suspensions equilibrated with the chlorides in the concentration range of 90 to 200 mg/liter. These results support the findings of others that an increase in the concentration of calcium ions reduces the copper binding capacity of the bottom oozes in water bottles. This indicates that electrostatically bound heavy metals will enter the solution phases as calcuim ions and magnesium ions increase in the water, as may happen in a change from river to estuarine and marine systems. In dilute freshwater copper can compete with other divalent cations, but in seawater desorption of copper will occur because of the overabundance of other cations. (Baker-FRC)
W82-00172

**SORPTION OF TRACE CADMIUM ON CLAY MINERALS AND RIVER SEDIMENTS: EFFECTS OF PH AND CD(II) CONCENTRATIONS IN A SYNTHETIC RIVER WATER MEDIUM,**
State Univ. of New York at Binghamton. Dept. of Chemistry.
J. D. Reid, and B. McDuffie.
Water, Air, and Soil Pollution, Vol 15, No 3, p 375-386, April, 1981. 7 Fig, 33 Ref.

Descriptors: *Cadmium, *Sorption, Clays, Minerals, *Sediments, Fluvial sediments, Rivers, Acidity, Chemical properties, Hydrogen ion concentration.

Cadmium (II) sorption was studied at initial cadmium concentrations ranging from 1 to 1000 micrograms/liter with a constant solid phase concentration of 0.5 g/liter. The percentage sorbed at equilibrium increased sharply from pH 6.5 to 9.0, with a shift toward increased adsorption at lower initial concentrations, indicating specific, non-equivalent sites. Freundlich log-log plots were linear, with a slope of 0.83. Susquehanna River sediments (silt/clay fraction) showed similar behavior, sorbing cadmium somewhat more strongly than illite, as did montmorillonite, while kaolinite sorbed cadmium less strongly. Sorption on illite was not altered appreciably by removing the iron or manganese oxide coating with dithionite, by removing organic matter with hydrogen peroxide, or by using a carbonate-free medium. Equilibration time, desorption at lower pH, and the effect of citrate in shifting the sorption to higher pH were also studied. The data are presented in terms of cadmium speciation equilibria and possible sorption mechanisms. (Baker-FRC)
W82-00174

**CHEMISTRY OF PRECIPITATION AT GAINESVILLE, FLORIDA,**
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
C. D. Hendry, and P. L. Brezonik.
Environmental Science and Technology, Vol 14, No 7, p 843-849, July, 1980. 7 Fig, 2 Tab, 36 Ref.

Descriptors: *Precipitation, *Chemical analysis, *Acid rain, Acidic water, Sulfuric acid, Nitric acid, Nitrogen, Phosphorus, Nutrients, Eutrophication, Lakes, Plankton, Magnesium, Potassium, Sodium, Chlorides, Calcium, Rainwater analysis, *Florida.

Wet-only precipitation was collected manually from June 1976 to July 1977 on the University of Florida campus. Bulk precipitation was collected about 8 km northwest of Gainesville at a cypress swamp site located on a large pine plantation. Chemical analyses were performed on both types of samples. The rain was shown to be the predominant deposition mechanism for SO4(2-), NH4(+), NO3(-), Mg(2+), and K(+). Dry fallout is of comparable importance to rainfall for deposition of Na(+), Cl(-), and Ca(2+). Heavy metal levels were highly variable in both types of samples. The average concentrations of total nitrogen, NH4(+), and NO3(-) in bulk precipitation were 0.82, 0.12, and 0.23 mg nitrogen/liter, respectively. Averages for ortho and total phosphate were 24 and 85 micrograms phosphate/liter, respectively, in bulk precipitation and 19 and 34 micrograms/liter in wet-only samples. Highest nutrient concentrations occurred in spring and early summer. Total loadings of nitrogen and phosphate from bulk precipitation are above permissible rates, relative to eutrophication, for shallow lakes. The volume-weighted mean pH of wet-only precipitation was 4.53; bulk precipitation had a slightly higher pH. Lowest pH values occurred in spring and summer. Acidity titrations and ionic balances indicate that rainfall acidity resulted mainly from sulfuric acid (69%) and nitric acid (23%). (Baker-FRC)
W82-00185

**WATER-ROCK PARTITION COEFFICIENTS AND THE COMPOSITION OF NATURAL WATERS - A REASSESSMENT,**
Marine Biological Association of the United Kingdom, Plymouth (England).
D. R. Turner, A. G. Dickson, and M. Whitfield.
Marine Chemistry, Vol 9, No 3, p 211-218, June, 1980. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Statistical analysis, *Rocks, *Chemical composition, *Seawater, Mathematical studies, Water analysis, Correlation analysis, Correlation coefficients.

The concept of a chemical steady state in the world ocean system is reevaluated on the basis of recent data on world average river composition and global mean composition of crustal rocks. The initial statistical analyses have been modified to reflect the new data. Improved correlations were found between mean oceanic residence times and water-rock partition coefficients. Also, improved correlations were found between water-rock partition coefficients and the electronegativity function. Such correlations give support to the idea that the average composition of seawater can be estimated using the electronegativities of the elements and the rate of input of dissolved components. Thus, a simple dynamic model is possible. Further, a detailed study of the scavenging of Th, Pb, Cu, Ni, and Cd in the marine environment suggests rapid rates of reaction which would favor the maintenance of a chemical steady state in the world oceans. (Small-FRC)
W82-00284

**BASIN LANDSCAPE-HALOGEOCHEMICAL METHOD OF EVALUATING THE NATURAL AND RECLAMATION CONDITIONS OF IRRIGATED TERRITORIES,**
Akademiya Nauk SSSR, Moscow. Inst. of Soil Chemistry and Soil Science.
I. N. Stepanov, M. N. Brynskikh, O. S. Matveeva, N. I. Savitova, and E. I. Chembarisov.
Water Resources (English Translation), Vol 7, No 1, p 77-81, January/February, 1980. 3 Tab, 11 Ref. Translated from Vodnye Resursy, No 1, p 171-176, 1980.

Descriptors: *River basin development, *Chemical composition, Salts, Rivers, Mineralization, Minerals, Syr Darya Basin, Kura River Basin, Colorado River Basin, River water.

A new method for regional evaluation of the reclamation condition of irrigated territories is proposed. The method is based on using data from observations by the USSR Hydrometerological Service Administration on the hydrological and hydrochemical regime of river, irrigation and collector-drain waters. The method has the advantage that it uses long-term series of observations from 40 to 100 years, which are expanding with each additional year. The basin method is based on concepts concerning the effect of the soil cover on the chemical nature of river waters. The sequence of removal of ions from soils to river water and the change in their composition have a certain regularity which gives grounds to assume the opposite, that is, on the basis of the mineral content and chemical relationships of water from a flow draining a particular irrigated tract, its natural and reclamation condition can be judged. Use of the method to study the Syr Darya basin, the Kura basin and the Colorado River basin suggests that under various conditions, a relationship is noted between the water-management development of territories and the mineralization (chemical composition) of the waters of rivers draining them. (Baker-FRC)
W82-00303

**HYDROCHEMISTRY OF A DOLOMITE KARST: THE BRUCE PENINSULA OF ONTARIO,**
Department of the Environment, Burlington (Ontario). Lands Directorate.
D. W. Cowell, and D. C. Ford.
Canadian Journal of Earth Sciences, Vol 17, No 4, p 520-526, 1980. 5 Fig, 2 Tab, 20 Ref.

Descriptors: *Hydrology, *Karst, Dolomite, *Chemical composition, Calcium, Magnesium, Carbonates, Seasonal variations, Georgian Bay, Lake Huron, Lakes, Bays, Canada, Bruce Peninsula, Peninsulas, Chemical analysis, Water analysis, *Chemical properties, Hardness, Rivers, Wetlands, Surface waters.

The characteristics of waters of the Bruce Peninsula, a low-lying, karstified dolomite surface at latitude 45 N, were investigated. A total of 250 samples representing six hydrochemical environments were collected. These environments included: Georgian Bay and Lake Huron; inland lakes; rivers and streams; wetlands; conduit-flow springs; and diffuse-flow springs. The seasonal behavior and chemical separation of these waters are examined. Except for Georgian Bay and Lake Huron, the waters of the peninsula were very hard, ranging from 180-320 ppm Ca(2+) plus Mg(2+) (as CaCO3), and displayed increasing hardness as the summer season progressed. Surface recharge and conduit-flow springs were generally saturated with respect to calcite and dolomite. Only diffuse-flow springs, which are among the hardest of waters, are commonly undersaturated. These waters are also the easiest to distinguish chemically, and results of a linear discriminant function analysis suggest that other waters of the peninsula represent a single class. (Baker-FRC)
W82-00321

**NITROGEN FIXATION AND METHANE METABOLISM IN A STREAM SEDIMENT-WATER SYSTEM AMENDED WITH LEAF MATERIAL,**
Waterloo Univ. (Ontario). Dept. of Biology.
T-Y. Tam, C. I. Mayfield, and W. E. Inniss.
Canadian Journal of Microbiology, Vol 27, No 5, p 511-516, May, 1981. 4 Fig, 1 Tab, 25 Ref.

Descriptors: *Methane, *Nitrogen fixation, *Sediments, Streams, Leaves, Bacteria, Nitrification, Oxidation, Aerobic conditions, Anaerobic conditions, Ecosystems.

Although studies have been performed on the effect of allochthonous input of leaf materials on the energy budget in running water energy systems, there have been no previous studies of the effects of leaf material on the nitrogen cycle in streams. The present investigation focused on the reduction of acetylene and the production and oxidation of methane in a stream sediment-water system amended with either fresh leaves or autumn shed leaves incubated in the presence and absence of air. There was no net methane production in the sediment-water system except when leaf material was added. The addition of fresh leaves resulted in 2.2 times the methane accumulation found when autumn-shed leaves were added. Net methane production was not significantly affected by static incubation in the presence of air, with such production being about the same as anaerobic rates with fresh leaves or 79% of the anaerobic rates with autumn-shed leaves. The addition of leaf material readily supported acetylene reduction under aerobic conditions in the sediment-water system, while significantly less reduction of acetylene occurred under anaerobic gas phase incubation conditions. Fresh leaves were also more stimulatory of acetylene reduction than were autumn-shed leaves. (Carroll-FRC)
W82-00486

**MEASUREMENTS OF HYDROGEN PEROXIDE IN RAINWATER,**
Harvey Mudd Coll. Claremont, CA. Dept. of Chemistry.
G. L. Kok.
Atmospheric Environment, Vol 14, No 6, p 653-656, 1980. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Hydrogen peroxide, *Rain, *Oxidation, Chemical reactions, Precipitation, Claremont, California, *Rainwater.

Levels of hydrogen peroxide (H2O2), an important component of the polluted and clean troposhere, were measured in rainwater at Claremont, California, during rainfall events in 1978 and 1979. Concentrations were typically 1-160 ppb, but on three occasions levels in excess of 1 ppm were obtained: (1) September 5, 1978, a very intense evening shower, 1.59 ppm during the first three hours of rain, (2) July 17, 1979, an early morning shower, 1.14 ppm, and (3) January 31, 1979, during electrical storm activity, 1.09 ppm. H2O2 levels generally decreased with time during a storm. Measured values of H2O2 were lower than those predicted from the uptake of gas phase H2O2 into clouds. Possible mechanisms of loss are destruction during evaporation and reaction with SO2 or other acidic species. The predominant mechanism for uptake of H2O2 into rainwater is washout. (Cassar-FRC)
W82-00497

## 2L. Estuaries

**CARBON ISOTOPES AS INDICATORS OF THE SOURCE AND FATE OF CARBON IN RIVERS AND ESTUARIES,**
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5B.
W82-00033

**NEAP-SPRING TIDE SEQUENCES OF INTERTIDAL SHOAL DEPOSITS IN A MESOTIDAL ESTUARY,**
Utrecht Rijksuniversiteit (Netherlands). Dept. of Sedimentology.
J. R. Boersma, and J. H. J. Terwindt.
Sedimentology, Vol 28, No 2, p 151-170, April, 1981. 13 Fig, 1 Tab, 20 Ref.

Descriptors: *Intertidal areas, *Tidal effects, *Sediment deposition, *Estuaries, Neap tides, Spring tides, Shoals, Sand waves, Dunes, Erosion, Westerschelde estuary, *Netherlands.

The hydrographic properties, the distribution and response pattern of various types of bedforms, and the sedimentary structures produced were observed in the mesotidal Westerschelde estuary, the Netherlands. Ebb and flood tides generally differed in strength; the resulting dominance changed over the neap-spring tide period. Parallel, long-crested sand waves and irregular short-crested dunes responded differently to the neap-spring variation in current velocity. The internal structure largely consisted of unidirectional cross-bedding, separated into a succession of tidal bundles, each formed during one tide. These tidal bundles were arranged in a lateral sequence reflecting neap-spring tide periods and differed in character with location. Within the tidal bundle, reactivation, full vortex and slackening structures reflected acceleration, full stage, and deceleration of flow, respectively, in the dominant tide, usually the flood tide. The full vortex structures tended to be well developed around spring tide and disappear towards neap tide. The subordinate tide carved pause planes which enclose the tidal bundles. These pause planes can be either erosional or depositional. (Cassar-FRC)
W82-00112

**GEOCHEMISTRY OF A SUBARCTIC SALT MARSH ENVIRONMENT,**
National Water Research Inst., Burlington (Ontario). Process Research Div.
W. A. Glooschenko, and J. A. Capobianco.
Marine Geology, Vol 37, No 3/4, p 231-240, September, 1980. 1 Fig, 3 Tab, 31 Ref.

Descriptors: *Salt marshes, *Chemical composition, Trace elements, Marshes, Geochemistry, Tidal marshes, Magnesium, Calcium, Potassium, Iron, Manganese, Silicon, Aluminum, Phosphorus, Sulfur, Titanium, Copper, Lead, Nickel, Cobalt, Cadmium, Chromium, Mercury, Zinc, North Point, *Ontario.

Samples were taken from a coastal salt marsh located at North Point, Ontario, on the southwestern shore of James Bay. The climate of the area is subarctic, with a dominant upland vegetation of northern boreal forest and large inland areas of bog and fen peatlands. The area is underlain by Paleozoic rocks of Ordovician, Silurian, and Devonian age. Extensive silty tidal flats are present, which are reworked by ice scouring during periods of thaw. The elements Ti, Mg, Ca, K, Na, Fe, Mn, Si, Al, P, and S were determined in the samples by x-ray fluorescence. Trace elements Cu, Pb, Ni, Co, Cd, Cr, and Zn were determined by digesting 2.5 g of sediment with a mixture of HCl/HNO3 and using atomic absorption spectrophotometry. The studies indicated that the parent material from which the sediments were derived, i.e., is Paleozo-

ic carbonates rather than Canadian Shield igneous and metamorphic rocks, is the major controlling factor determining elemental composition of these materials. Other factors such as acidic or basic nature of aluminosilicates, hydrated iron oxides, clay and sand content, sulfides, and organic matter influence sediment composition within the salt marsh in terms of total elemental compositon. However, since the marsh sediments and soil represent a system changing through time, with exposure to saline and fresh water, and thus varying redox potential, it would be expected that sediments would change in terms of soluble and exchangeable cations and anions. (Baker-FRC)
W82-00148

**PERPETUAL SHOALS AT THE ENTRANCE TO CHESAPEAKE BAY: FLOW-SUBSTRATE INTERACTIONS AND MUTUALLY EVASIVE NET CURRENTS,**
Waterways Experimental Station, Stevenville, MD.
M. A. Granat, and J. C. Ludwick.
Marine Geology, Vol 36, No 3/4, p 307-323, July, 1980. 5 Fig, 1 Tab, 27 Ref.

Descriptors: *Water currents, *Bays, Bights, Sounds, Estuaries, *Chesapeake Bay, *Substrates, Shoals, Sandbars, Mud flats, Sediment, Tidal currents, Wave action.

Shoals in coastal plain estuaries are sites of greater-than-average net sediment accumulation which exist in a state of quasi-equilibrium with tidal currents and wave action. Studies of the Inner Middle Ground Nine Foot Shoal, a compound parabolic shoal in the entrance to the Chesapeake Bay, indicate that it is in dynamic interaction with mutually evasive ebb and flood tidal currents. This interaction is perpetuated through a close relationship between flow and substrate. A modest change in one attribute as a result of natural or man-induced variation causes a change in the other in an attempt to maintain a pseudo-balanced system. Comparisons among six bathymetric surveys taken during the past 127 years trace development of the shoal from two linear sediment bodies to its present double parabolic morphology. The existing particle size distributions of the surface sediments are systematically related to the present morphology and seem to be in adjustment with the ambient currents. Tidal currents of the area were sufficient in velocity to easily erode the surface sediments of the shoal. Various flow asymmetries or inequalities were examined from eight current meter stations to determine the dominant directions and to summarize the hydraulic regime. Different flow dominance was indicated depending on the attribute considered. Bathymetric influence on the flow direction of near-bottom currents is illustrated by diverted currents and shielding. Sediment circulation cell was a manifestation of the mutual evasion of ebb and flood tidal currents. Feedback exists between flow and substrate and results in a system in quasi-equilibrium. (Baker-FRC)
W82-00149

**GEOMORPHIC AND HYDRAULIC EVOLUTION OF TIDAL CREEKS ON A SUBSIDING BEACH RIDGE PLAIN, NORTH INLET, S.C.,**
South Carolina Univ., Columbia. Dept. of Geology.
L. R. Gardner, and M. Bohn.
Marine Geology, Vol 34, No 3/4, p M91-M97, February, 1980. 3 Fig, 14 Ref.

Descriptors: *Tidal marshes, *Evolution, Beaches, Erosion, Shores, *Submergence, Drowning, Submerged lands, Tide lands, North Inlet, South Carolina.

Stratigraphic and geomorphic features of a small marsh basin near Noth Inlet, South Carolina, are described. The basin is in an early stage of evolution under conditions of slow submergence. These features suggest that the tidal creek draining this basin was originally a small fresh-water stream which has gradually adjusted its hydraulic geometry to an increasing volume of tidal flow imposed by submergence. A generalized model of the evolution ofhydraulic geometry in response to submergence is presented as a complement to the Mudge-Davis model of marsh evolution. The dominant sediment of the interridge area of marsh was shown to be sand. Mud and silt were confined to a relatively narrow zone along the main tidal channel. That the area was originally a coastal forest much like that landward of the present marsh is evidenced by the presence of stumps and roots in the sandy sediment of the marsh along with occasional relic cat eye ponds on the surface of the sandy marsh. In the early stages of its adjustment to tidal influence the stream apparently eroded a considerable volume of sand, which subsequently was partly replaced by mud. Eventually the entire watershed of the original stream will be subject to tidal inundation, and further growth in the volume of tidal flow will subside. The stream will then achieve a condition of mature stability, in which the meanders have little tendency to migrate. (Baker-FRC)
W82-00150

**EFFECT OF CATIONS ON COPPER ADSORPTION BY KAOLIN,**
Maryland Univ. Eastern Shore, Princess Anne. Dept. of Natural Sciences.
For primary bibliographic entry see Field 2K.
W82-00172

**INFLUENCE OF ESTUARINE SEDIMENT ON VIRUS SURVIVAL UNDER FIELD CONDITIONS,**
Baylor College of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5A.
W82-00199

**ENRICHMENT AND ASSOCIATION OF BACTERIA AND PARTICULATES IN SALT MARSH SURFACE WATER,**
Stanford Univ., CA. Dept. of Civil Engineering.
R. W. Harvey, and L. Y. Young.
Applied and Environmental Microbiology, Vol 39, No 4, p 894-899, April, 1980. 3 Fig, 1 Tab, 31 Ref.

Descriptors: *Bacteria, *Salt marshes, *Particulate matter, Tidal effects, Population dynamics, Tidal marshes, Surface water, Sippewissett salt marsh, Massachusetts, Palo Alto salt marsh, California.

The relationship between particulate material and populations of surface layer bacteria was investigated in a salt marsh. At two sampling sites, Sippewissett salt marsh in Falmouth, Massachusetts, and Palo Alto salt marsh in Palo Alto, California, elevated counts of bacteria were found during outgoing tides in surface microlayers. The degrees by which bacteria were concentrated into the surface microlayer were linearly dependent upon surface concentration of particulate matter. Bacterial populations in the subsurface water were largely planktonic, but a significant percentage of the bacteria in the microlayer were attached to particulate material. Both bacterial populations were grown on seawater nutrient agar, and the microlayer bacteria grew more successfully than did the bacteria from subsurface waters. Successful growth was positively correlated with the fraction of bacteria attached to particulate matter. It seems that the particulates in the microlayer waters of the salt marsh influenced the observed increase in both the readily grown and the total numbers of bacteria. (Small-FRC)
W82-00201

**POPULATIONS OF METHANE-PRODUCING BACTERIA AND IN VITRO METHANOGENESIS IN SALT MARSH AND ESTUARINE SEDIMENTS,**
Clemson Univ., SC. Dept. of Microbiology.
W. J. Jones, and M. J. B. Paynter.
Applied and Environmental Microbiology, Vol 39, No 4, p 864-871, April, 1980. 6 Tab, 29 Ref.

Descriptors: *Methane bacteria, *Marine sediments, *Salt marshes, Methane, Estuaries, Spartina, Sediments, Sapelo Island, Georgia.

The methanogenic populations of various marine sediments, particularly salt marsh sediments, were quantified, and the in vitro rates of sediment methanogenesis were measured. Most probable numbers of methanogens were determined using an anaerobic, habitat-simulating culture medium with 80% H2 plus 20% CO2 as substrate. Methane producing organisms were found at all depths tested (0 to 36 cm) in salt water and salt marsh sediments. For the short Spartina marsh sediments of Sapelo Island, Georgia, populations were maximal at the 5 to 7 cm depth, while in the tall Spartina marsh, populations were maximal in the upper 0 to 2 cm zone. In vitro rates of methanogenesis with short Spartina sediments incubated under 80% H2-20% CO2 indicated that the 5 to 7 cm region exhibited maximal activity. When incubated under 100% N2 rates of methanogenesis were similar to rates with 80% H2-20% CO2. Replacing the N2 with H2 resulted in an eight-fold decrease in the rate of methanogenesis. (Small-FRC)
W82-00202

**SPECIFIC INHIBITION OF NITRITE OXIDATION BY CHLORATE AND ITS USE IN ASSESSING NITRIFICATION IN SOILS AND SEDIMENTS,**
Cawthron Inst., Nelson (New Zealand).
L. W. Belser, and E. L. Mays.
Applied and Environmental Microbiology, Vol 39, No 3, p 505-510, March, 1980. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Nitrification, *Intertidal areas, Sediments, Soils, Nitrates, Oxidation, Ammonium, Chlorates, Natural waters, New Zealand.

The selectivity of chlorate inhibition on the oxidation of nitrite, with respect to possible inhibition of ammonium oxidation, was investigated. The purpose was to develop a method for measuring ammonium oxidizer activity in which only nitrite need be measured. Initial work was carried out with intertidal sediments collected at the Delaware Inlet, Nelson, New Zealand. Two pasture soils were also used, one a Wakapuaka sandy loam and the other a Ronga silty loam. Both soils were in permanent clover grass pastures grazed by either sheep or cattle. The application of chlorate to the samples prevented nitrite from being oxidized to nitrate. The effectiveness and specificity of chlorate were then tested with pure cultures of nitrite and ammonium oxidizers, as well as in soil and sediment slurries. It was concluded that chlorate had relatively little inhibitory effect on ammonium oxidation. However, under some conditions chlorate was not completely effective in blocking nitrite oxidation, and the causes of this were investigated. The technique was designed to check for incomplete blockage. The technique as developed had two advantages over methods where both nitrite and nitrate are measured. First, when automated methods are not available, nitrite is much simpler to measure and requires a smaller sample size. Second, in soils with high nitrate background, this method will be much more sensitive, as nitrite will normally be undetectable at the beginning of the incubation. (Baker-FRC)
W82-00242

**EFFECT OF ESTUARINE SEDIMENT PH AND OXIDATION-REDUCTION POTENTIAL ON MICROBIAL HYDROCARBON DEGRADATION,**
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
G. A. Hambrick, III, R. D. DeLaune, and W. H. Patrick, Jr.
Applied and Environmental Microbiology, Vol 40, No 2, p 365-369, August, 1980. 5 Fig, 19 Ref.

Descriptors: *Sediments, *Hydrocarbons, Mineralization, *Estuarine environment, Estuaries, Coasts, Acidity, Oxidation, *Microbial degradation, Microorganisms, Degradation, Bottom sediments.

The objective of this study was to determine and compare the relative rates of mineralization in estuarine sediment of two C-14 labeled petroleum hydrocarbons, octadecane and naphthalene, as affected by different pH levels and redox potentials. Three sets of sediment-water suspensions were used, incubated at one of three pH levels, 5.0, 6.5, or 8.0. Hydrocarbon mineralization rates were in-

ferred from the activity of respired carbon dioxide. Sediment pH and oxidation-reduction potential were important factors governing the population of hydrocarbon-degrading microorganisms in the sediment and subsequent mineralization rates. Highest mineralization rates occurred at pH 8.0, and the lowest occurred at pH 5.0. At all pH levels mineralization decreased with decreasing oxidation-reduction potential, that is, increasing sediment anaerobiosis. In general, mineralization rates for octadecane were greater than those for naphthalene. Aerobic microorganisms in the oxidized sediment were more capable of degrading hydrocarbons than anaerobic microorganisms in reduced sediment of the same pH. (Baker-FRC)
W82-00243

**ENUMERATION AND RELATIVE IMPORTANCE OF ACETYLENE-REDUCING (NITROGEN-FIXING) BACTERIA IN A DELAWARE SALT MARSH,**
Delaware Univ., Newark. Coll. of Marine Studies.
H. J. Dicker, and D. W. Smith.
Applied and Environmental Microbiology, Vol 39, No 5, p 1019-1025, May, 1980. 2 Fig, 2 Tab, 42 Ref.

Descriptors: *Bacteria, *Salt marshes, Marshes, Bacterial analysis, Nitrification, Tidal marshes, Nitrogen, Seasonal variations, Temperature effects, Clostridium, Azotobacter, Desulfovibrio, *Delaware, *Nitrogen fixation.

Four sites were selected for study in the Canary Creek marsh adjacent to the University of Delaware Marine Station facilities in Lewes, Delaware. The stations were located in four different vegetational areas of the marsh. Three groups of N2-fixing bacteria were enumerated from the top centimeter of the surface in the four areas. The results over a period of sampling for nine months showed that there were no discernible seasonal patterns for any of the groups enumerated (Azotobacter sp., Clostridium sp., and Desulfovibrio sp). Azotobacter sp. were present in numbers of 10 to the seventh power per g of dry mud, whereas the two anaerobic fixers were present in much lower numbers, 10 to the third power to 10 to the fourth power per gram of dried mud. There were no differences in the numbers of each group among the different vegetational areas, thus indicating that there was a heterogeneous population of N2 fixers present. Additional studies indicate that the activity of sulfate reducers (Desulfovibrio sp.) may account for as much as 50% of the total observed acetylene reduction activity. Oxygen was found to exert little effect on the observed acetylene reduction activity, indicating that stable aerobic and anaerobic microenvironments exist in the surface layer of marsh sediments. (Baker-FRC)
W82-00248

**DOES SALT MARSH FERTILIZATION ENHANCE SHELLFISH PRODUCTION. AN APPLICATION OF FLOW ANALYSIS,**
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
J. T. Finn, and T. M. Leschine.
Environmental Management, Vol 4, No 3, p 193-203, May, 1980. 3 Fig, 2 Tab, 27 Ref.

Descriptors: *Fertilizers, *Shellfish, *Flow, *Nitrogen compounds, Nutrients, Marshes, Wetlands, Salt marshes, Ecosystems, Barataria Bay, Louisiana, Sippewissett Marsh, Massachusetts, Model studies, Wastewater disposal, Spartina, Aquatic plants.

Flow analysis was used to determine that adding nitrogen fertilizer to Spartina salt marsh sediment was not an efficient way to enhance shellfish growth. Nitrogen flow models for Barataria Bay salt marsh, Louisiana, and Sippewissett Marsh, Cape Cod, indicated that in both locations only 3% of added N reached the shellfish, despite the great physical differences and despite the inclusion of considerably more microbial processing of N in the Barataria Bay model. The most efficient N transfer would have to bypass Spartina growth, decomposition, and detrital feeding. (Cassar-FRC)
W82-00259

**THERMOSTABILIZATION OF ENTEROVIRUSES BY ESTUARINE SEDIMENT,**
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
P-F. Liew, and C. P. Gerba.
Applied and Environmental Microbiology, Vol 40, No 2, p 305-308, August, 1980. 5 Fig, 17 Ref.

Descriptors: *Sediments, *Enteroviruses, *Estuarine environment, Temperature effects, Adsorption.

The protection of viral infectivity via adsorption to particulates was investigated. Particular attention was given to the possibility of an increased resistance to thermoinactivation resulting from the contact of the viruses with sediments. Dried estuarine sediment and artificial seawater were used in the study. The effect of sediment on enterovirus survival was assessed by comparing inactivation of a virus inoculum added to 40 ml of seawater in a 100-ml flint-glass bottle with inactivation of a similar virus inoculum in an identical volume of seawater containing sediment. The final concentration of virus in each bottle was 25,000 plaque-forming units per ml. Poliovirus survival was prolonged at 24 and 37C, but not at 4C in the presence of sediment over the time periods observed. Further inactivation studies were performed at 50 and 55C to maximize the thermal effects, and similar protection was noted. The supernatant fluid from a mixture of seawater and sediment lacked a protective effect against thermoinactivation, suggesting that prolonged virus survival in the presence of sediment was due to adsorption to particulates. From these observations it appears that the adsorption of enteroviruses to estuarine sediments may play a significant role in protecting them against thermoinactivation. (Baker-FRC)
W82-00263

**THE ABUNDANCE OF ESTUARINE LARVAL AND JUVENILE FISH IN A SOUTH CAROLINA INTERTIDAL CREEK,**
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
E. L. Bozeman, Jr., and J. M. Dean.
Estuaries, Vol 3, No 2, p 89-97, June, 1980. 5 Fig, 3 Tab, 26 Ref.

Descriptors: *Estuaries, *Fish populations, *Larvae, *Juvenile fish, *North Inlet Estuary, *South Carolina, Intertidal areas, Tides, Saline water fish, Marine fish, Aquatic environment, Aquatic animals, Wildlife, Immature growth stage, Eel, Atlantic menhaden, Creeks.

The population of larval and juvenile fish was measured in a small intertidal creek in the North Inlet Estuary, South Carolina, during October 1974 to May 1975. Five species accounted for 99.3% of the 573,739 individual fish captured: spot, Leiostomus xanthurus; pinfish, Lagodon rhomboides; Atlantic menhaden, Brevoortia tyrannus; Atlantic croaker, Micropogon undulatus; and speckled worm eel, Myrophis punctatus. A total of 16 species were represented. The collection method, blocking the channel at high tide and catching the fish in a quantitative sampling net as they left on the ebb tide, was reliable. Larvae were most abundant in February and March and moved to the open sea in the spring. (Cassar-FRC)
W82-00276

**THE SIGNIFICANCE OF THE SUBMARINE GEOLOGY OF UPPER SPENCER GULF, SOUTH AUSTRALIA, TO ENVIRONMENTAL DECISION-MAKING,**
Adelaide Univ. (Australia). Dept. of Geology.
J. R. Hails, V. A. Gostin, and G. E. Sargent.
Search, Vol 11, No 4, p 115-116, April, 1980. 2 Fig.

Descriptors: *Environmental effects, *Shore protection, Water pollution effects, Sediment transport, Aquatic plants, Ecological effects, Sea grasses, Mangrove swamps, Clays, Metals, Fate of pollutants, *Spencer Gulf, *Australia, Estuaries.

Study of more than 300 undisturbed vibrocores and box cores from the upper Spencer Gulf, South Australia, indicated that environmental damage could result from proposed industrial development in the coastal areas. Any damage to the extensive seagrass meadows or mangrove plants by pollutants or physical removal could interrupt shoreline equilibrium, releasing shell grit and sand to fill channels. Pollutants discharged into the water would be likely to remain in the nearshore environment because of poor water circulation and adsorption by the underlying stiff clays. (Cassar-FRC)
W82-00314

**EFFECT OF SOLAR RADIATION AND PREDACIOUS MICROORGANISMS ON SURVIVAL OF FECAL AND OTHER BACTERIA,**
Tasmania Univ., Hobart (Australia). Dept. of Agricultural Science.
J. McCambridge, and T. A. McMeekin.
Applied and Environmental Microbiology, Vol 41, No 5, p 1083-1087, May, 1981. 1 Fig, 3 Tab, 14 Ref.

Descriptors: *Sewage bacteria, *Estuarine environment, *Solar radiation, Seawater, Bacteria, Escherichia coli, Coliforms, Predation, Pathogens.

Although the effect of solar radiation on the survival of sewage bacteria in seawater has received considerable attention, little attention has been paid to pathogens and fecal matter other than coliforms or to the interaction between naturally occurring microbial predators and solar radiation. This study compared the survival of a range of bacteria associated with feces when exposed to solar radiation and examined the interrelationship between microbial predators and solar radiation in estuarine water samples. Significantly greater declines in the numbers of Escherichia coli cells were observed in estuarine samples exposed to both naturally occurring microbial predators and solar radiation than in samples exposed to only one of these factors. The effect of solar radiation on microbial predators was found to be negligible. However, sewage bacteria were susceptible to ligh-induced decay in varying decrees. Klebsiella pneumoniae had the lowest survival rate in estuarine water samples both in the dark and when exposed to solar radiation. The survival rates of the other sewage bacteria were next lowest for E. coli, followed in order of increasing survival levels by Salmonella typhimurium, Streptococcus faecium, Enterobacter aerogenes, and Erwinia herbicola. These results demonstrate that naturally occurring microbial predators and solar radiation interact to produce part of the observed decline of sewage bacteria in estuarine water samples and that different bacteria are affected by solar radiation to different degrees. (Carroll-FRC)
W82-00491

# 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

## 3C. Use Of Water Of Impaired Quality

**GROUND WATER ALTERNATIVES AND SOLUTIONS,**
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 6D.
W82-00029

**TREATMENT OF FLORIDA SURFACE WATERS FOR USE IN PHOSPHATE BENEFICIATION,**
Bureau of Mines, University, AL. Tuscaloosa Research Center.
For primary bibliographic entry see Field 5D.
W82-00048

**CROPPING SYSTEMS FOR TREATMENT AND UTILIZATION OF MUNICIPAL WASTEWATER AND SLUDGE,**
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5E.
W82-00097

**NITROGEN AVAILABILITY FROM SEWAGE SLUDGE,**
Vermont Univ., Burlington. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 5E.
W82-00158

**COASTAL BERMUDAGRASS YIELD AND SOIL PROPERTIES AS AFFECTED BY SURFACE-APPLIED DAIRY MANURE AND ITS RESIDUE,**
Alabama Agriculture Experimental Station, Auburn.
Z. F. Lund, and B. D. Doss.
Journal of Environmental Quality, Vol 9, No 1, p 157-262, January-March, 1980. 9 Fig, 1 Tab, 6 Ref.

Descriptors: *Land disposal, *Manure, *Grasses, Crop yield, Farm wastes, *Fertilizers, *Bermudagrass, Dairy industry, Nitrogen, Acidity, Water pollution sources.

An experiment was performed to yield information on how manure affects soil properties and how long plants respond to residue from surface-applied manure. Dairy manure was applied for three years as a solid at rates of 45 and 90 metric tons/ha/yr and as a liquid at rates of 45, 90, and 135 metric tons/ha/yr on plots of Ditham loamy sand and Lucedale fine sandy loam. Mineral fertilizers were used on control plots. At the beginning of the residual phase of the study, residue from the manure three years after the final application was still producing considerably higher yields of coastal bermudagrass on both soils compared to the check plots. By the end of three cropping seasons, nitrogen was one of the most important limiting factors of production on both soils. Manure application increased levels of K and Mg and the pH of the subsoils. There was some downward movement of P. Thus, manure can be used to correct subsoil acidity in coarse-textured soils. However, the landspreading of manure may cause problems by polluting runoff and groundwater. (Small-FRC)
W82-00195

**AMES' MUTAGENIC ACTIVITY IN RECYCLED WATER FROM AN ISRAELI WATER RECLAMATION PROJECT,**
Johns Hopkins Univ., Baltimore, MD. Dept. of Environmental Health Sciences.
For primary bibliographic entry see Field 5D.
W82-00234

**EFFECTS OF TILLAGE AND GYPSUM INCORPORATION ON RAIN RUNOFF AND CRUST STRENGTH IN FIELD SOILS IRRIGATED WITH SALINE-SODIC WATER,**
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 2A.
W82-00327

**IRRIGATION TAILWATER MANAGEMENT,**
California Univ., Davis. Dept. of Land, Air, and Water Resources.
K. K. Tanji, J. W. Biggar, R. J. Miller, W. O. Pruitt, and G. L. Horner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-196925, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-034a, July 1981. 5 p, 1 Fig, 2 Ref.

Descriptors: *Irrigation water, *Irrigation-return flow, *Tailwater, Water quality, Water supply, Water reuse, Dissolved solids, Suspended sediments, Pesticide residues, Agricultural chemicals, Water conservation, Cost analysis, *Impaired water use, *Central Valley, California.

Irrigation tailwater and other components of irrigation return flows were investigated in two representative sites in the Central Valley of California. Management of tailwater depends on the quantity and the quality of the water. When water is scarce tailwater is not discharged, or is used close to the site of production. Beneficial uses of tailwater include irrigation of crops and pasture, maintenance of wetland/waterfowl habitats, livestock water supply, groundwater recharge, maintenance of low flows in stream beds, repulsion of salinity in tidal estuaries, fish migration and spawning, warm water fish habitat, navigation, recreation and aesthetics, and municipal/industrial water supply. The use will depend on the quality of the water as well as the quantity. Poor quality of tailwater is caused by the presence of dissolved mineral salts, sediments, and agricultural chemicals. There is no single, universally-applicable control technology for irrigation tailwater, but low cost methods involve reducing the production of tailwater. This may be done by changing methods, use of variable interest and cost rates, and differential water costs. (Brambley-SRC)
W82-00392

**RECLAIMING AND REUSING WASTEWATER,**
California Univ., Berkeley.
For primary bibliographic entry see Field 5D.
W82-00402

**THE HARVEST OF MICROALGAE FROM THE EFFLUENT OF A SEWAGE FED HIGH RATE STABILIZATION POND BY TILAPIA NILOTICA. PART 2: STUDIES OF THE FISH PONDS,**
Asian Inst. of Tech., Bangkok (Thailand). Div. of Agricultural and Food Engineering.
P. Edwards, O-A. Sinchumpasak, and M. Tabucanon.
Aquaculture, Vol 23, No 1-4, p 107-147, April, 1981. 6 Fig, 6 Tab, 25 Ref.

Descriptors: *Fish ponds, *Wastewater treatment, *Growth, Stabilization ponds, Algae, Phytoplankton, Effluent, Economic aspects, Tilapia, Fish stocking, Biomass, *Impaired water use.

Utilization of sewage-grown phytoplankton as in situ food for algae-feeding fish provides a potentially economic means of harvesting this protein source. The growth of Tilapia nilotica as a function of the concentration of phytoplankton in the water was investigated to acquire information needed for the design of fish culture systems involving the recycling of organic wastes. Phytoplankton concentration was varied by changing the flow rates and therefore the detention times of the fish ponds receiving wastes from a high rate stabilization pond. Tilapia nilotica grew well in the 4-cum concrete fish ponds, but ceased to grow after 3 months, regardless of stocking density or mean pond algal concentration. A fish stocking density of 10 per cubic meter may produce a high yield of small individual fish suitable for animal feed. Yields obtainable using a 4-cubic meter concrete pond system based on 3 month growing seasons may be similar to those for larger earth ponds with a single fish crop each year. A linear relationship exists between fish yields and mean phytoplankton concentration in the fish ponds. Good fish growth may be achieved with algal concentrations of 70 milligrams per liter. The dominance of phytoplankton in fish guts and the high crude food conversion ratios, based on phytoplankton added and retained in the fish ponds, demonstrated the high nutritional value of waste grown microalgae. Reductions of detention time, and therefore of mean pond phytoplankton concentrations, resulted in increases in the efficiency of fish production per unit phytoplankton biomass. Since fish growth was directly correlated with mean pond phytoplankton concentration, maximum efficiency would require large areas of land to obtain significant fish yields. (Carroll-FRC)
W82-00456

**THE HARVEST OF MICROALGAE FROM THE EFFLUENT OF A SEWAGE FED HIGH RATE STABILIZATION POND BY TILAPIA NILOTICA. PART 3: MAIZE CULTIVATION EXPERIMENT, BACTERIOLOGICAL STUDIES, AND ECONOMIC ASSESSMENT,**
Asian Inst. of Tech., Bangkok (Thailand). Div. of Agricultural and Food Engineering.
P. Edwards, O-A. Sinchumpasak, V. K. Labhsetwar, and M. Tabucanon.
Aquaculture, Vol 23, No 1-4, p 149-170, April, 1981. 3 Fig, 5 Tab, 17 Ref.

Descriptors: *Land application, *Fish ponds, *Wastewater treatment, Effluents, Nitrogen, Crop yield, Irrigation, Coliforms, Algae, Phytoplankton, Economic aspects, Stabilization ponds, *Impaired water use.

The fertilization potential of effluent from a fish pond, which in turn received effluent from a sewage-fed high rate stabilization pond, for maize cultivation was investigated. Plots received composite fish pond effluent, raw sewage, or tap water and one of three levels of commercial nitrogen fertilizer. A linear relationship was found between maize yield and total nitrogen applied, regardless of the nitrogen source. However, differences in soil fertility prevented the development of an absolute relationship between maize yield and total nitrogen applied. Effluent from the fish ponds contained higher concentrations of fecal coliforms than are permitted under the World Health Organization standard for wastewater reuse for crops eaten cooked and for fish culture. Significant amounts of algae passed through the fish ponds when the phytoplankton concentration was high enough to produce good fish growth. As a result, a large land area was required for the maize crops irrigated with effluent from the ponds. About 63 hectares would be needed to treat and recycle domestic wastewater from a city of 100,000 people. The land area ratios were 1.86:1:10.25 for the high rate stabilization pond, the fish pond, and the maize plot, respectively. The study results suggest that there is little advantage in incorporation of a high rate pond in a fish-maize system, since fish do not harvest the phytoplankton as efficiently as they are produced in the high rate stabilization pond and since fecal coliform counts are high in the fish pond effluent. Use of a stabilization pond system composed entirely of earth ponds modified for fish and crop cultivation as well as for waste treatment probably would provide a more effective means of recycling sewage into fish. If a high rate stabilization pond is to be used, direct harvesting of the phytoplankton from the effluent for use as animal feed is probably the most practical means to exploit the system. (Carroll-FRC)
W82-00457

**SODIUM-POTASSIUM RATIOS IN SOIL SOLUTION AND PLANT RESPONSE UNDER SALINE CONDITIONS,**
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
D. Devitt, W. M. Jarrell, and K. L. Stevens.
Soil Science Society of America Journal, Vol 45, No 1, p 80-86, 1981. 3 Fig, 3 Tab, 23 Ref.

Descriptors: *Wastewater disposal, *Salinity, *Crop production, *Potassium, *Sodium, Land disposal, Soil solution, Effluents, Irrigation, Electric powerplants, Electrical conductivity, Nutrients, Soil-water-plant relationships, Chemical composition.

The use of cooling tower water from electrical generating plants to irrigate agricultural crops is being investigated. These effluents are quite saline and are usually high in sodium and comparatively low in potassium, resulting in a low potassium to sodium ratio. This study investigated the soil and plant factors that might affect the uptake and distribution of potassium by wheat plants irrigated with high-sodium, low-potassium water synthesized to represent cooling tower water. Lysimeters filled with either Holtville clay loam or San Emigdio sandy loam planted with wheat were irrigated with three concentrations of simulated cooling tower waters at electrical conductivities of 2.1, 4.2, or 7.1 mmho per centimeter. The concentrations of both sodium and potassium in the saturation extracts increased and the accumulation of sodium in leaves of the wheat plants greatly increased when the salinity of the irrigation water was increased. A significant inverse relationship was found between the potassium in plant leaves and the depth-weighted potassium in solution, as well as between sodium in leaves and potassium in leaves at harvest. The product of potassium/sodium in soil solution and the root length density, summated over

each depth increment sampled, was found to be the best indicator of the potassium to sodium ratio found in leaves at harvest. The ratio of potassium to sodium concentrations found in the soil solution appears to be a better indicator of potassium uptake by wheat than is the absolute concentration of potassium measured in the solution. (Carroll-FRC)
W82-00469

## 3D. Conservation In Domestic and Municipal Use

**WATER AND WASTEWATER RECLAMATION: AN ECONOMICAL ANSWER TO INDUSTRIAL WASTES AND POLLUTION,**
Culligan Inc., Northbrook, IL.
For primary bibliographic entry see Field 3E.
W82-00188

**BEFORE THE WELL RUNS DRY: A HANDBOOK FOR DESIGNING A LOCAL WATER CONSERVATION PLAN.**
New England River Basins Commission, Boston, MA.
Available from the USGS, Dist. Br. Text Prod. Sect. 604 S. Pickett St. Alexandria, VA. 22304, Price: $4.50. Geological Survey Resources and Land Investigations Program Report, October 1980. 95 p, 30 Fig.

Descriptors: *Water conservation, *Water management, *Planning, *Water supply, Water use, Municipal water, Domestic water, Water loss, Drought, Water shortage, Water demand, Water costs, Potential water supply, Public utility districts, *New England River Basins Commission.

A seven-step procedure for designing a water conservation plan is described in textbook fashion. This procedure forces the water supplier to consider the full range of options available and the potential impacts of each option on the utility, the users, and the community. The handbook presents five supply management programs to consider which will reduce water loss and waste within the supply system. In addition to the supply management programs, three demand management programs, pricing, education, regulation and their impacts are discussed. (USGS)
W82-00396

**WATER CONSERVATION DEVICES FOR NEW OR EXISTING DWELLINGS,**
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sharpe.
Journal of the American Water Works Association, Vol 73, No 3, p 144-149, March, 1981. 4 Tab, 10 Ref. OWRT-A-999-PA(7), 14-34-0001-1140.

Descriptors: *Performance evaluation, *Water conservation, *Plumbing, Urban areas, Retarded flow, Flow regulators, Flow velocity, Domestic water.

The performance of water conservation devices and fixtures developed for home use is discussed. Many devices have been developed to reduce the amount of water used to flush a toilet, including dams, partitions, and various inserts to displace water in toilet tanks. Damming, displacement, and flush mechanism modification devices are compared on the basis of water use reduction efficiency, cost installation problems, and performance under conditions of actual use. Maximum water reduction efficiencies occurred with two-cycle flush mechanism devices. Other flush modifications rated second, and toilet dams rated third. These results do not indicate solids clearance from the toilet bowl or deal with other potential problems. Plastic bottles were the easiest device to install and also cost the least. Toilet dams were the next cheapest, followed by flush modification mechanisms. Little information is available on performance. One study found that 100% of bottles installed were still in place two years later, while only 42, 50, and 92% of other toilet devices were still in place. There have also been problems with water saving toilets, specifically inadequate flushing of solid material in some installations. Shower devices and water faucet devices have performed satisfactorily. (Small-FRC)
W82-00401

## 3E. Conservation In Industry

**GERBER SAVES 465,000 GALLONS OF WATER/DAY,**
R. Banner.
Food Engineering, Vol 52, No 3, p 105-107, March, 1980. 1 Fig.

Descriptors: *Water reuse, *Food processing industry, Industrial wastes, Water demand, Drought, Economic aspects, Reclaimed water, Water renovation, Cooling water, Economic aspects.

Gerber was able to reduce its water usage in Oakland, California from 500,000 gallons per day to 35,000 per day, just by recycling cooling water used in its hot-fill and retort cooking process. A further refinement planned for the system will enable Gerber to save as much as $40,000 per year in steam-generating costs, by recycling hot water as well as cool water. Gerber originally had considered water conservation 16 years ago, when the plant was remodeled, and had the necessary equipment installed at that time. However, it was the cost of utilities and energy, triggered by the California drought of 1977, that made the system attractive enough to use. In this system, Gerber is reusing the cooling water that has passed through the retorts and sterilizer/cooler. This is accomplished by cooling and filtering the water for reuse rather than flushing the cookers with a fresh supply of city water for each cook cycle. When the whole system begins to operate, about 314,000 gallons of water will be saved per day. (Baker-FRC)
W82-00187

**WATER AND WASTEWATER RECLAMATION: AN ECONOMICAL ANSWER TO INDUSTRIAL WASTES AND POLLUTION,**
Culligan Inc., Northbrook, IL.
J. Mulvihill.
Industrial Wastes, Vol 26, No 4, p 14-16, July/August, 1980. 1 Fig.

Descriptors: *Industrial wastes, *Reclaimed water, Water, Water reuse, Wastewater renovation, Water use, Wash water, Impaired water use.

Several examples are cited of water being reused or made to serve several purposes before being discharged to the sewer system. One example, in operation at many places in the United States, involves the washing of trucks, buses and trains, where the wash water is recycled for reuse. Another example is found in a motel, where the shower and sink water from the motel rooms is chlorinated, passed through a multi-media depth filter, then through a carbon filter, rechlorinated, and used for on-premise laundry. The laundry wastewater is collected and goes through the same type of system as the motel gray water. Water from the laundry gray water system is colored and scented and used for toilet flushing. A third type of process using reclaimed water is a coal processing plant reusing its coal washing wastewater. The reclamation process involves chemical clarification followed by alternating multi-media filters. Additional examples include a rolling steel mill, a cannery, and a metal conduit manufacturer. Designing such a system requires thorough knowledge of the incoming water's chemical and biological make-up, the breakdown of chemical components being used in the process and their effects, the chemical and physical elements added to the water during its intended use, and the available treatment methods, both chemical and physical in nature. (Baker-FRC)
W82-00188

## 3F. Conservation In Agriculture

**PERFORMANCE OF BEARING CHERRY AND PRUNE TREES UNDER VERY LOW IRRIGATION RATES,**
S & E Irrigated Agriculture Research and Extension Center, Prosser, WA.
E. L. Proebsting, Jr., J. E. Middleton, and M. O. Mahan.
Journal of the American Society for Horticultural Science, Vol 106, No 2, p 243-246, March, 1981. 4 Tab, 9 Ref.

Descriptors: *Irrigation requirements, *Fruit crops, Cherries, Prunes, Trees, Trickle irrigation, Soil moisture, Wilting point, Plant growth, Washington, Water shortage, Soil water, Water requirements, Agriculture, Water conservation, Orchards, Water stress.

The minimum amount of irrigation water needed to keep cherry (Prunus avium L.) and prune (Prunus domestica L.) trees alive during a 1 year water shortage was studied in Washington during 1976, the pre-test year; 1977, the stress period; and 1978-1979, the recovery period. During the stress period, total water applied to cherry trees by daily or weekly trickle irrigation was 30,200 liters per tree at 100% of evaporation, 16,000 at 50%, and 4,300 at 15%. Total amounts applied to prunes were approximately half that of the cherry trees. Although soil moisture remained above the wilting point for 100% evaporation treatments, it reached the wilting point at 50% and 15% except near the emitters. At 15% of evaporation irrigation rate, trees survived but growth of fruit and vegetative parts was reduced and leaves dropped early in the fall. Flower bud development was not affected. Cherry trees showed dieback of peripheral branches during 1977 and 1978 and grew and fruited normally by the third year after treatment. Prunes at 15% responded similarly and recovered well by 1978. The 50% rate produced a diminished fruit yield of prunes and cherries in 1977, but yields and growth were normal the following year. (Cassar-FRC)
W82-00119

**OPTIMAL DESIGN OF FURROW IRRIGATION SYSTEMS,**
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
J. M. Reddy, and W. Clyma.
Transactions of the ASAE, Vol 24, No 3, p 617-623, May/June, 1981. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Furrow irrigation, *Irrigation efficiency, *Optimization, Economic aspects, Farms, Costs, Design criteria, Irrigation practices, Agriculture.

Furrow irrigation system design was optimized using a combination of generalized geometric programming and the Soil Conservation Service design procedure. Water, labor, and ditch construction costs were minimized. Variables in the system included: inflow rate, time of inflow, length of run, number of lengths of run, number of sets, and number of furrows per set. The problem was formulated in terms of cost coefficients, design variables, and system physical constraints. A sample field was designed. The method delineates that particular combination of design variables that minimizes the cost while satisfying system constraints. The procedure can be used to design and operate furrow irrigation systems with efficiency and can improve on-farm water management. The design procedure could be improved by basing the design on maximum profit and by including additional decision variables. (Small-FRC)
W82-00138

**FURROW IRRIGATION PRACTICES IN NORTHERN COLORADO,**
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
T. W. Ley, and W. Clyma.
Transactions of the ASAE, Vol 24, No 3, p 610-116, 623, May/June, 1981. 4 Fig, 2 Tab, 14 Ref.

Descriptors: *Furrow irrigation, *Performance evaluation, *Irrigation practices, Irrigation, Irrigation efficiency, Farms, Agriculture, *Colorado.

Furrow irrigation evaluations were conducted for four years on several farms in the Fort Collins and Greeley areas of Colorado. Data from six farms was used to define state-of-the-art irrigation practices and priority problems in the area. Researchers found that while marginally acceptable designs could be achieved for the longer run lengths from 400 m to 800 m, improved system performance could be attained on the run lengths of 400 m or less. Eighty-five percent of the irrigations evaluated had unacceptable performance levels. Low water application efficiencies resulted from high runoff losses. Low water requirement efficiencies resulted from cumulative soil water deficits, poor timing, and insufficient applications. Farmers tended to irrigate too soon, and under- and over-irrigation were common. Proper requirements and management could improve water application efficiencies to 75 to 95% and water requirement efficiencies to 85 to 100%. (Small-FRC)
W82-00139

**WATER, ENERGY AND LABOR REQUIREMENTS FOR FUTURE PACIFIC NORTHWEST IRRIGATION,**
Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6A.
W82-00143

**ECONOMICS OF SNOW MANAGEMENT FOR AGRICULTURE IN THE GREAT PLAINS,**
Colorado State Univ., Fort Collins. Dept. of Economics.
J. R. Snyder, M. D. Skold, and W. O. Willis.
Journal of Soil and Water Conservation, Vol 35, No 1, p 21-24, January/February, 1980. 1 Fig, 8 Tab, 5 Ref.

Descriptors: *Agriculture, *Snow management, *Cost-benefit analysis, Wheatgrasses, Barriers, Soil moisture, Wheat, Water conservation, Economic aspects, Precipitation, *Snowmelt, *Crop production.

A successful method for managing snow to increase infiltration into cropland is the use of tall (3-5 ft) wheatgrass barriers planted along topographic lines and perpendicular to prevailing winds. At Akron, Colorado, grass barriers combined with continuous cropping produced 43% more crop per acre than the traditional crop-fallow system without barriers. The amount of soil water stored averaged 150% of soil water accumulated on nearby fallow land. In Culbertson, Montana, the continuous cropping-barrier system produced an extra 15 bushels per acre of winter wheat and five bushels per acre of spring wheat compared with the conventional crop-fallow system. Net returns per acre-year were $10-$20 depending on whether the crop was originally spring or winter wheat. Profitability varied widely over the years studied, 1968-1975, depending on precipitation. Snow management practices may be of little benefit in years with low snowfall or adequate growing season precipitation. (Cassar-FRC)
W82-00178

**FIELD TEST OF AN IRRIGATION SCHEDULING COMPUTER MODEL,**
Soil and Irrigation Research Inst., Pretoria (South Africa). Dept. of Agriculture and Fisheries.
W. S. Meyer, and G. C. Green.
Water SA, Vol 7, No 1, p 43-48, January, 1981. 2 Fig, 3 Tab, 10 Ref.

Descriptors: *Irrigation requirements, *Evapotranspiration, *Computer models, Model studies, Irrigation efficiency, Transpiration, Evaporation, Mathematical models, Lysimeters, Crop yield, Wheat, Soil water, Field tests, Pretoria, *South Africa.

The United States Department of Agriculture Irrigation Scheduling Model was tested on wheat crops grown at Roodeplaat, near Pretoria, in 1979. The rate of evapotranspiration was predicted using current meteorological information. The model also utilizes a crop water use coefficient, irrigation forecasts, and soil water balance data. Results obtained during 1978 were examined to adjust the model for local conditions. Amounts of soil water depletion predicted by the model were in close agreement with those measured from soil samples. Experimental plots yielded about the same amount of grain as plots irrigated according to actual ET losses measured by weighing lysimeters stationed on the same location. However, predicted ET was higher than measured ET, so that the scheduled plots received more water than was probably required. (Geiger-FRC)
W82-00184

**WATER APPLICATION UNIFORMITY OF HOSE TOWED TRAVELER IRRIGATORS,**
Auburn Univ., AL. Agricultural Experiment Station.
R. L. Collier, and E. W. Rochester.
Transactions of the ASAE, Vol 23, No 5, p 1135-1138, 1980. 10 Fig, 1 Tab, 2 Ref.

Descriptors: *Irrigation systems, *Sprinkler irrigation, Application rates, Agriculture, Farm equipment, Irrigation engineering.

Two hose-towed traveler irrigators were studied to determine the effects of linear speed of the sprinkler carriage, reel rotation speed, flow rate, and water pressure on the uniformity of application. One irrigator was a 5-layer irrigator; the other was an irrigator with three layers of hose. Considering the diameter of the reel, a 44% theoretical increase in travel speed would be expected from beginning to end of the travel lane for the 5-layer irrigator and 24% for the 3-layer. Measured variations in travel speed averaged 42% for the 5-layer and 23% for the 3-layer. As the hose became wrapped on the reel, discharge and pressure at the nozzle decreased. Increased flow resistance caused the system to shift to a higher pump rate at a lower flow rate. The combined effect of all factors resulted in average final depths of application of 68% and 77% of initial depth for the 5-hose and 3-hose machines, respectively. (Cassar-FRC)
W82-00296

# 4. WATER QUANTITY MANAGEMENT AND CONTROL

## 4A. Control Of Water On The Surface

**REVIEW OF REPORTS FOR FLOOD CONTROL; WESTCHESTER COUNTY STREAMS, NEW YORK.**
Army Engineer District, New York.
Report, July, 1981, 75 p, 15 Fig, 12 Tab.

Descriptors: *Flood control, *Cost-benefit analysis, *Flood damage, Environmental effects, Cost analysis, Economic aspects, Disasters, *Westchester County, New York.

Numerous communities in Westchester County, New York have historically experienced serious problems due to flooding of the many streams draining the county. High intensity of prolonged rainfall such as occurred during recent floods have threatened the health and safety of the public and caused millions of dollars in damages, resulting in the county being declared a Federal Disaster Area. Flood control projects along the Saw Mill River in the Town of Chappequa and the City of Yonkers have been authorized and are presently under construction; flood control projects along the Saw Mill River in the Village of Ardsley and the Village of Elmsford - Town of Greenburgh have been authorized and are presently in the advanced engineering and design phase; and interim reports for flood control have been submitted to Congress for the Saw Mill River, Mamaroneck and Sheldrake Rivers, and the Byram River. Investigations are continuing for the Saw Mill River in the Nepera Park area of Yonkers and Nannyhagen Brook in Mount Pleasant. For the remaining areas in Westchester County, the investigations conducted in response to the study authority as well as the small flood control program have indicated that Federal flood control projects are not warranted at this time due to the lack of sufficient economic and environmental benefits to justify the cost of protective measures. (Moore-SRC)
W82-00103

**USE OF RIVER WATERS THAT DID NOT REACH THE ARAL SEA AS A CONSEQUENCE OF ECONOMIC ACTIVITY DURING 1961-1975,**
Akademiya Nauk SSSR, Moscow. Inst. Geografii.
E. N. Minaeva.
Water Resources (English Translation), Vol 7, No 5, p 418-422, September/October, 1980. 1 Tab, 15 Ref. Translated from Vodnye Resursy, No 5, p 82-88, September/October, 1980.

Descriptors: *Hydrologic budget, *Rivers, *USSR, Aral Sea, Irrigation, Water use, Reservoirs, Evaporation, Soil water, Water loss, Percolation, Seepage, Transpiration, Phreatophytes, Canals, Drainage water.

Intensification of irrigation agriculture in the Soviet Union resulted in the Aral Sea experiencing a shortfall of 215 cubic kilometers over the period 1961 through 1975. The State Hydrologic Institute estimated possible items of its expenditure, both lump-sum and constant, using extensive data reflecting the characteristics of the development of water management during this period. Water management developments included interbasin water transfers, creation of several shallow reservoirs on the plains, and new irrigation of large areas. All of the data were obtained by direct calculations, except for the volumes of waters filling soil pores on newly irrigated lands. Items of lump-sum water expenditure which were estimated include filling of reservoirs, filling of closed depressions with drainage waters, formation of water lenses under canals, and filling of soil pores on irrigated lands. Estimates were also developed for the following items of constant water expenditure: evaporation from irrigated lands, transpiration by phreatophytes in the zone of influence of large canals, evaporation from the water surfaces of reservoirs, evaporation from the water surfaces of depressions filled with drainage waters, and evaporation from large permanent canals. The methods of estimating each of these components of the water expenditure are described. The volumes of waters filling soil pores on newly developed lands were determined as the remainder from the calculations made. (Carroll-FRC)
W82-00190

**A SUCCESSFUL TRANSFER,**
Welsh Water Authority (Wales).
P. Goodman.
Water, No 33, p 19-20, July, 1980. 2 Fig.

Descriptors: *Water supply development, *Water transfer, *Diversion, *Wales, Diversion structures, Great Britain, Water supply, Rivers, Water conveyance, Interbasin transfers.

The small margin between existing normally available resources and actual consumption in south east Wales prompted the development of a water transfer scheme designed to meet the needs of homes and industries in South Gwent and Cardiff. Under the Wye Abstraction Scheme, 136.3 million liters per day will be diverted from the Wye and transferred across Gwent into the existing water supply there by pipeline. Additional discharges will be made from the Elan Valley reservoirs, located near the head of the Wye catchment, during periods of low flow in the river. An intake and pumping station will abstract the water from the Wye. The abstracted water will be transferred through 32 kilometers of 1.2 meter diameter steel pipeline direct to a new storage reservoir, where it can be treated for use in an area now using water from the Usk River and the Llandegfedd reservoir. Water from those sources will then be released for use in the Cardiff area. Provision will also be made for direct transmission of the water in the new

storage reservoir to treatment facilities serving the Cardiff area. The reservoir will serve as a buffer against river pollution and allow the pumps to be shut down during very dirty river conditions. The abstraction represents just over two percent of the average daily flow of the Wye and about four percent of the average flow during summer months. The intake facility has been designed to keep water velocity to a minimum to prevent fish, particularly salmon, from being drawn in and to keep silt out of the pumping station. The intermittent high and low flows in the upper Wye which will result from the abstraction scheme may tend to attract spawning fish into the river. (Carroll-FRC)
W82-00309

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: SKAGIT RIVER BASIN, WASHINGTON.**
Federal Energy Regulatory Commission, San Francisco, CA. Office of Electric Power Regulation.
For primary bibliographic entry see Field 6D.
W82-00368

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: LEWIS RIVER BASIN, WASHINGTON.**
Federal Energy Regulatory Commission, San Francisco, CA. Office of Electric Power Regulation.
For primary bibliographic entry see Field 6B.
W82-00370

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: PIT RIVER BASIN, CALIFORNIA.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
For primary bibliographic entry see Field 6B.
W82-00373

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: CLARK FORK-PEND OREILLE RIVER BASIN, MONTANA, IDAHO, WASHINGTON.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
For primary bibliographic entry see Field 6B.
W82-00374

**AN ANALYSIS OF RESERVOIR STORAGE CONTENTS FOR THE PROPOSED ENLARGEMENT OF BUMPING LAKE IN WASHINGTON,**
Geological Survey, Tacoma, WA. Water Resources Div.
J. H. Bartells.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $1.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-440, 1981. 10 p, 1 Fig, 2 Tab, 3 Ref.

Descriptors: *Reservoir storage, *Storage capacity, *Reservoir operation, *Water supply, Reservoirs, Lakes, Reservoir releases, Reservoir capacity, Reservoir yield, Reservoir fisheries, Irrigation, Water rights, Hydrologic data, Hydrographs, *Washington, *Bumping Lake.

Monthend contents of the proposed Bumping Lake enlargement in Washington were determined for the period 1917-73 by using the historic streamflow record as a basis for inflow to the reservoir and imposing certain operational requirements on reservoir releases. The operational requirements used were those set forth in the Environmental Statement that was prepared for the project by the U.S. Water and Power Resources Service (formerly the U.S. Bureau of Reclamation). The computations show that after starting with an empty reservoir on October 1, 1917, the 458,000 acre-feet capacity of the enlarged lake could be nearly full (384,000 acre-feet) on November 30, 1925, which is the starting scenario given in the Environmental Statement. From 1925 to 1973 the computations compare favorably with those shown in the Environmental Statement, with minor differences due to releases of fish enhancement water. In all cases studied, all fishwater requirements and all existing irrigation requirements were met, and generally from 30,000 to 90,000 acre-feet of extra irrigation water could be available in most years. (USGS)
W82-00421

## 4B. Groundwater Management

**BASIN MANAGEMENT IN THE SAN BERNARDINO VALLEY,**
East San Bernardino City Water District, CA.
L. W. Rowe.
Water/Engineering and Management, Vol 128, No 5, p 79-80, 83, May, 1981.

Descriptors: *River basin development, *Watershed management, *Monitoring, Water quality, Water supply development, Water quality management, Wastewater treatment, *San Bernardino Valley, California, Groundwater management.

The San Bernardino Valley Municipal Water District manages the San Bernardino basin through monitoring, planning, and operation. Water quality data are collected for 60 key points within the district, including 13 streams and 45 wells. Basin production is monitored along with current and projected land use. Planning entails performing water supply studies for the eight service areas, including investigating the feasibility of wheeling in supplemental water or pumping groundwater from one system to another if required. Groundwater modeling is also performed. Wastewater treatment needs are being evaluated for five service areas. Operational programs include the establishment of the Santa Ana River-Mill Creek Cooperative Water Project Committee which pools area water to provide a stable water supply for all. Also, a recharge program discharges state project water into existing water conservation facilities at high elevations. The cooperative pumping agreement demonstrates the feasibility of obtaining water out of one purveyor's distribution system and conveying it to another. (Small-FRC)
W82-00075

**PRELIMINARY DATA FROM A SERIES OF ARTIFICIAL RECHARGE EXPERIMENTS AT STANTON, TEXAS,**
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00085

**A 10-YEAR PLAN TO STUDY THE AQUIFER SYSTEM OF INDIAN WELLS VALLEY, CALIFORNIA,**
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 6D.
W82-00086

**AN OBSERVATION-WELL NETWORK CONCEPT AS APPLIED TO NORTH CAROLINA,**
Geological Survey, Raleigh, NC. Water Resources Div.
M. D. Winner, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-106089, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-13, March 1981. 59 p, 24 Fig, 12 Tab, 11 Ref.

Descriptors: *Observation wells, *Networks, *Monitoring, *Groundwater management, Aquifers, Water level fluctuations, Discharge measurement, Geohydrologic units, Wells, Pumping, Groundwater recharge, Hydrologic data, Data collections, Data processing, *North Carolina.

A statewide observation-well program is proposed for North Carolina based on four networks of observation wells with different but clearly-defined objectives. These are referred to as the (1) climatic-effects network, (2) terrane-effects network, (3) local-effects network, and (4) areal-effects network. The characteristics of each network are related to natural and man-made stresses in aquifers, and the areas and hydrogeologic units in North Carolina where these networks are needed are identified. Formats for collection, processing, and publication of data from these networks is suggested. (USGS)
W82-00414

**DIGITAL MODEL OF THE UNCONSOLIDATED AQUIFER SYSTEM IN THE MODESTO AREA, STANISLAUS AND SAN JOAQUIN COUNTIES, CALIFORNIA,**
Geological Survey, Menlo Park, CA. Water Resources Div.
C. J. Londquist.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-102559, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigation 81-12, July 1981. 36 p, 17 Fig, 1 Tab, 19 Ref.

Descriptors: *Model studies, *Geohydrology, *Aquifers, *Confined groundwater, Groundwater movement, Pumping, Transmissivity, Groundwater recharge, Water level, Finite difference methods, *California, Modesto, Stanislaus County, San Joaquin County, *Groundwater availability.

A digital mathematical model of the unconsolidated alluvial aquifer system in the Modesto area, Calif., has been developed which can be used to determine the effects of increased pumping and water use of future water levels in the aquifer system. The model is divided into two units. The lower unit is confined in the western part of the study area by a confining clay bed; elsewhere in this unit the aquifer is unconfined. The upper unit represents an unconfined aquifer and lies above the clay bed or its extension. Where the clay bed is absent the upper and lower units are considered as a single aquifer. The model, as calibrated, can evaluate with reasonable accuracy the effects on water levels of changing stresses and stress patterns only within the area of primary interest for the upper unit. In other areas of the upper unit and for the lower unit, predicted changes should be looked upon as, at best, representing only general trends. (USGS)
W82-00415

**PROPOSED OBSERVATION-WELL NETWORKS AND GROUND-WATER LEVEL PROGRAM FOR NORTH CAROLINA,**
Geological Survey, Raleigh, NC. Water Resources Div.
M. D. Winner, Jr.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Price: $9.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-544, 1981. 69 p, 29 Fig, 14 Tab, 8 Ref.

Descriptors: *Observation wells, *Network design, *Monitoring, *Groundwater, Aquifers, Water level fluctuations, Discharge measurements, Geohydrologic units, Wells, Pumping, Groundwater recharge, Hydrologic data, Data collections, Data processing, *North Carolina.

An initial system of 223 observation wells is proposed for monitoring ground-water levels in North Carolina. These wells are suggested to replace and upgrade nearly 650 observation wells currently measured in separate State and Federal programs, and are arranged in four groups or networks each having specific objectives. These groups are (1) a climatic-effects network, (2) a terrane-effects network, (3) a local-effects network, and (4) an areal-effects network. Recommendations are also made regarding additional observation-well coverage in some areas of the State. Records review and network review procedures constituted the largest amount of effort in this study and required a considerable amount of organization to keep track of well records and water level data. These procedures are outlined in this report as a guide for those who are contemplating an observation-well program review. The report also contains suggested organizational contents of a data file, including

procedures for records processing, and various forms used to document the review and data-collection efforts. (USGS)
W82-00426

## 4C. Effects On Water Of Man's Non-Water Activities

**QUARTERLY PROGRESS REPORT, NATIONWIDE URBAN RUNOFF PROGRAM.**
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5G.
W82-00044

**PREMINING HYDROLOGIC CONDITIONS OF FIVE SOUTHEASTERN OHIO WATERSHEDS,**
Bureau of Mines, Denver, CO. Denver Research Center.
G. E. McIntosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-135055, Price codes: A05 in paper copy, A01 in microfiche.
In: Surface Coal Mining Reclamation Equipment and Techniques, Proceedings: Bureau of Mines Technology Transfer Seminars, Evansville, Indiana, June 3, 1980 and Denver, Colorado, June 1980. Bureau of Mines Information Circular 8823, 1980. p 60-73, 6 Fig

Descriptors: *Strip mines, *Coal mines, *Water quality, *Hydrologic data, Groundwater, *Ohio, Precipitation, Infiltration, Erosion, Land reclamation, Watersheds, Watershed management.

In Appalachia, land is being disturbed by surface mining at an accelerating rate to obtain coal for electric power production and other uses. Five watersheds, range in size from 29 to 52 acres, were selected to study the effects of mining and reclamation on hydrology and water quality. Four of these watersheds will be mined, and one will be used as a control. All the watersheds are located in east-central Ohio. The study watersheds in Coshocton County (C06 and A06) and the one in Muskingum County (M09) are located in the Muskingum River Basin. The two Jefferson County sites (J11 and J08) drain into small tributaries of the Ohio River. On each watershed soil and vegetation surveys were run, and geologic cores were obtained in order to determine baseline physical conditions. Weather stations were set up to monitor precipitation, temperature, relative humidity, wind speed, and solar radiation. Infiltration tests, surface water quality and quantity measurements, and ground water studies are being conducted. In addition to the monitoring of the watersheds, erosion and treatment plots have been set up at three of the mine sites. (Moore-SRC)
W82-00054

**HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1979,**
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00083

**EFFECT OF AGRICULTURAL LAND DEVELOPMENT ON DRAINAGE WATERS IN THE NORTH CAROLINA TIDEWATER REGION,**
North Carolina State Univ. at Raleigh.
For primary bibliographic entry see Field 5B.
W82-00094

**PHYSICAL EFFECTS OF VEHICULAR DISTURBANCES ON ARID LANDSCAPES,**
Stanford Univ., CA. Dept. of Applied Earth Sciences.
R. M. Iverson, B. S. Hinckley, R. M. Webb, and B. Hallet.
Science, Vol 212, No 4497, p 915-917, May, 1981. 1 Fig, 1 Tab, 20 Ref.

Descriptors: *Arid-zone hydrology, *Rainfall infiltration, *Soil erosion, *Surface runoff, Arid lands, Erosion, Erosion control, Infiltration capacity, Soil porosity, Mathematical studies, Runoff, Overland flow, Soil compaction, *Off-road vehicle effects.

The arid lands of the Southwestern part of the United States are increasingly being used for recreation by off-road vehicles. Such vehicles have been shown to cause damage to arid land hydrology by increasing the amount and frequency of water runoff and erosion by reducing soil porosity, infiltration capacity, and hydraulic resistance to overland flow. Natural surface stabilizers are also disrupted by vehicular travels. In 50 rainfall simulation tests, vehicle-used plots had about 5 times more runoff and 10-20 times greater sediment yield than adjacent unused plots. In a desert environment, such effects may occur even when use of off-road vehicles is light. Recovery times from vehicular damage are estimated to be nearly 100 years. Erosion rates were calculated from multivariate statistical analyses using 22 experimental factors. The character of the rainfall was identified as the most important variable in predicting increases in erosion. (Geiger-FRC)
W82-00111

**SLASH TREATMENT AFTER CLEARCUTTING LODGEPOLE PINE AFFECTS NUTRIENTS IN SOIL WATER,**
Utah State Univ., Logan. Dept. of Forestry and Outdoor Recreation.
G. E. Hart, N. V. DeByle, and R. W. Hennes.
Journal of Forestry, Vol 79, No 7, p 446-450, July, 1981. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Nutrients, *Forest soils, *Clear-cutting, Forests, Pine trees, Forest management, Cutting management, Coniferous trees, Industrial wastes, Organic wastes, *Waste disposal, Soil solution, Mulching, Incineration, Sodium, Phenols, Potassium, Magnesium, Calcium, Nitrate, Soil water.

Harvesting of old-growth coniferous forests in the northwest United States produces large volumes of organic debris which must be reduced to lower fire hazard, control insects, improve seedbeds, provide access, and/or ameliorate appearance. Changes in soil solution chemistry resulting from four slash disposal methods employed after clearcutting of old-growth lodgepole pine were investigated. The slash disposal methods used included nearly complete removal, spreading the residue as chips, broadcast burning, and windrow burning. Soil solutions from the areas which had been clearcut had slightly higher concentrations of sodium, potassium, magnesium, calcium, and nitrate than did those from an adjacent unharvested forest area. Effects on stream water resulting from leaching or runoff would be negligible and difficult to detect. High concentrations of nitrate-nitrogen were found in the intensively burned areas beneath windrows and following broadcast burning. Use of the residue as a mulch after near-complete harvesting resulted in a flush of phenolic compounds into the soil solution during the first post-treatment year. Phenol concentrations in soil solutions after mulching were significantly higher than acceptable levels for fish habitats. Broadcast burning apears to be preferable to windrow burning because it diffuses effects on soil and soil water over the entire area. Chemical composition of soil water appears to be least affected by residue disposal practices that cause minimal mechanical disturbance and minimal incorporation of organic matter into soil surfaces. (Carroll-FRC)
W82-00130

**ROCKY MOUNTAIN PIPELINE PROJECT: ENVIRONMENTAL IMPACT STATEMENT,**
Bureau of Land Management, Washington, DC.
For primary bibliographic entry see Field 5G.
W82-00394

**A MODEL OF NATURAL AND MAN-INDUCED CHANGES IN OPEN FRESHWATER WETLANDS ON THE MASSACHUSETTS COASTAL PLAIN,**
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
For primary bibliographic entry see Field 2I.
W82-00397

**USE OF FLOW-DURATION CURVES TO EVALUATE EFFECTS OF URBANIZATION ON STREAMFLOW PATTERNS ON LONG ISLAND, NEW YORK,**
Geological Survey, Syosset, NY. Water Resources Div.
K. R. Prince.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-114307, Price codes: A02 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 80-114, 1981. 19 p, 4 Fig, 4 Tab, 15 Ref.

Descriptors: *Flow duration, *Urbanization, *Streamflow, *Urban runoff, Urban hydrology, Base flow, Storm runoff, Water level, Pumping, Water supply, Sewer systems, Population dynamics, *New York, *Long Island, Nassau County, Suffolk County, Peak flow.

Streamflow patterns on Long Island, N.Y., have been changing over the last three decades in response to eastward population growth and urbanization. Flow-duration curves for nine streams in Nassau and Suffolk Counties indicate that, during this time, streams in urbanized areas have had increased peak flows and decreased base flows, whereas streams in sparsely populated areas have shown little or no change. The increase in peak flows reflects the greater volume of storm runoff from impermeable surfaces such as roads, parking lots, and roofs. The decrease in base flows results from the lowering of groundwater levels, principally by sanitary sewerage and extensive pumping for public water supply. At East Meadow Brook, in a sewered, densely populated area of Nassau County, peak flows (1-percent duration) increased by 41% during 1946-74, and base flows (98-percent duration) decreased by 99%. In contrast, peak and base flows of Carmans River, in a largely undisturbed, rural area of Suffolk County, showed fluctuations no greater than 19% during the same period. (USGS)
W82-00416

## 4D. Watershed Protection

**TERRACE PLANNING CRITERIA FOR RUNOFF CONTROL FOR DEEP LOESS SOIL,**
Harza Engineering Co., Chicago, IL.
P. Jacobson.
Transactions of the ASAE, Vol 24, No 3, p 699-704, May/June, 1981. 4 Fig, 8 Ref.

Descriptors: *Runoff, *Terracing, Land forming, Loess, Contour terracing, Geological terraces, Agriculture, Farming, Erosion, *Erosion control.

Procedures used to develop a water control system adapted for ease in farming are described. The system was based on 19 years of experience. Adoption of these procedures should alleviate most objections to terraces and other control measures. Specific planning criteria are to be used for: lands having slopes less than 6% with deeply entrenched waterways; lands of uniform slopes with minor waterway entrenchment; lands with slopes over 6% with deeply entrenched waterways spaced 120 meters or less horizontally; lands having slopes over 6% with deeply entrenched waterways spaced over 120 meters apart; and relatively flat, moderately rolling upland areas which are dissected by a few deeply entrenched waterways. The terrace planning criteria outlined for these various slopes and topographies proved to offer fairly straight row alignment on much of the experimental farm. This would not have been the case with conventional terrace layouts. This sets the stage for a practically erosion-free surface obtained through the use of terraces and fills. To maintain fertility and crop yields across the terrace interval, steep backslope terraces and gully fills designed for subsequent benching will necessarily be limited to deep soils. (Baker-FRC)
W82-00144

**PROTECTING AGRICULTURE'S NATURAL RESOURCE BASE,**
Iowa State Univ., Ames.
J. F. Timmons.
Journal of Soil and Water Conservation, Vol 35, No 1, p 5-11, January/February, 1980. 3 Tab, 28 Ref.

Descriptors: *Erosion control, *Water pollution prevention, *Soil conservation, *Agriculture, Iowa, Resources management, Water quality, Suspended sediments, Economic aspects, Cultivated lands, Conservation, Grain crops.

Soil erosion and associated water quality problems may replace petroleum as the nation's most critical natural resource problem. One factor influencing soil erosion on the individual farm level is the tendency to maximize immediate income at the expense of long term erosion control measures or of water quality at a distant site. On the national or international scale, increased demand for agricultural products and limitations to the capacity to produce these crops contribute to soil erosion. Some productive agricultural practices are discouraged by water quality standards imposed on suspended silt and chemical residuals. At the same time, increasing grain exports, changing meadows and forests to more erosion-susceptible agricultural use, and decreasing funds for soil conservation have compounded the erosion problem. Strategies for reducing soil losses are: (1) research and education, (2) the 'red ticket' strategy to require the unwilling few to submit to the majority will, (3) the 'green ticket' strategy, providing financial incentives to conserve soil, (4) complementary controls and incentives, (5) public investments on private land, (6) cushioning impacts of grain exports, (7) soil conservation districts, and (8) integrating soil erosion control with food assistance policies. Some of these strategies are illustrated by examples of court decisions and activities in Iowa. (Cassar-FRC)
W82-00176

**HYDRAULIC SEDIMENT MODEL STUDY FOR PROPOSED BLANCO DIVERSION DAM MODIFICATION,**
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8A.
W82-00446

# 5. WATER QUALITY MANAGEMENT AND PROTECTION

## 5A. Identification Of Pollutants

**TOXICITY OF MOUNT ST. HELENS ASH LEACHATE TO A BLUE-GREEN ALGA,**
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5C.
W82-00001

**MOUNT ST. HELENS VOLCANIC-ASH FALL IN THE BULL RUN WATERSHED, OREGON, MARCH-JUNE 1980,**
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W82-00002

**CHEMICAL INDICATORS OF ORGANIC RIVER SOURCES IN RIVERS AND ESTUARIES,**
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W82-00035

**DEVELOPMENT OF OIL-IN-WATER MONITOR, PHASE II,**
Southwest Research Inst., San Antonio, TX.
H. S. Silvus, Jr., F. M. Newman, and J. H. Frazar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-226251, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/4-80-040, August 1980. 45 p, 13 Fig, 8 Ref, 2 Append.

Descriptors: *Oily water, *Oil pollution, *Pollutant identification, *Hydrocarbons, Chromatography, *Monitoring, Oil industry, Chemical industry, Effluents, Fiber optics.

Wastewater from such sources as refineries, shale-oil recovery plants, coal-conversion operations, chemical plants, ships, offshore drilling platforms, petroleum-handling facilities, and other industries may contain harmful quantities of hydrocarbon materials in suspension. While installation and operation of wastewater treatment processes is a major step toward elimination of hydrocarbon pollution, to achieve maximum effectiveness it is necessary to monitor the effluent of a treatment process to insure that the system is functioning correctly. A new oil-in-water monitor technique brings together for the first time reverse-phase liquid chromatography and fiber optics. A special organophilic optical fiber, created by a chemical treatment process routinely used in reversed-phase liquid chromatography, collects and concentrates suspended hydrocarbon materials on its surface. Various methods of chemically treating an optical fiber and various treatment reagents were evaluated. For such aromatic hydrocarbons as n-hexylbenzene, cyclohexylbenzene, heptadecylbenzene, 3,3'-dimethylbiphenyl, and 1-phenylnaphthalene and for crude oil, detection thresholds of less than 3 mg/l were observed, and system reponse was linear over a contaminant concentration range of greater than 2.5 decades (greater than 300:1). Data indicate that the high end of the range can be extended if desired. (Moore-SRC)
W82-00100

**DETERMINATION OF PRIORITY POLLUTANT PHENOLS IN WATER BY HPLC,**
Altex Scientific, Berkeley, CA.
P. A. Realini.
Journal of Chromatographic Science, Vol 19, No 3, p 124-129, March, 1981. 6 Fig, 5 Tab, 13 Ref.

Descriptors: *Phenols, *Water analysis, Chromatography, Chemical analysis, Wastewater analysis, Pollutant identification.

An HPLC method is described for the analysis of waste water and drinking water for nanogram levels of phenols specified by the United States Environmental Protection Agency as priority pollutants. This classification includes: phenol, p-nitrophenol, o-chlorophenol, 2,4-dinitrophenol, o-nitrophenol, 2,4-dimethylphenol, 4-chloro-m-cresol, 2,4-dichlorophenol, 4,6-dintro-o-cresol, 2,4,6-trichlorophenol, and pentachlorophenol. Methylene chloride was used as the solvent for the concentration-extraction of phenols from water samples. After extraction the pH was adjusted to 14. Further extraction was carried out with methylene chloride. Both acidic and basic extracts were then combined and evaporated to dryness with a stream of nitrogen in a water bath. The sample was redissolved in 1 ml of acetonitrile and 10 microliters was injected directly onto the column. The calibration curve was linear between 1 ng and 50 ng. Extraction of phenols from waste water was also achieved with methylene chloride. The use of an ion-pair extraction in basic solution gave good recoveries, and the use of reversed-phase chromatography gave excellent separation of the priority pollutant phenols. (Baker-FRC)
W82-00110

**ORGANIC MICROPOLLUTION INDICES OF EFFLUENTS AND RENOVATED WATERS,**
Technion-Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
M. Rebhun, and J. Manka.
Water Research, Vol 15, No 7, p 789-801, July, 1981. 10 Fig, 4 Tab, 15 Ref.

Descriptors: *Water analysis, *Organic compounds, *Effluents, *Wastewater treatment, Pollutant identification, Trace levels, Solvents, Secondary wastewater treatment, Advanced wastewater treatment, Gas chromatography, Lime.

Solvent-extractable organics (SEO) were characterized in secondary and tertiary effluents by column fractionation, elution with solvents of different polarity, and gas chromatography. The most efficient solvent combination was benzene followed by chloroform. Diethyl ether alone was also a satisfactory eluant. In secondary effluents the SEO were 45% polar, 32% nonpolar, and the remainder, intermediate in polarity. Lime treatment removed 37% of the total SEO, 63% of the nonpolar compounds, 91% of the medium polarity compounds, and 53% of the polar compounds. After-lime polishing pond detention treatment removals were 68% of total SEO, 75% of nonpolar, 96% of medium polar, and 64% of polar. 74% of lindane and 97.5% of aldrin, respectively, were removed by after-lime flocculation and 97.4% and 100%, respectively, by after-lime flocculation plus detention. Electron capture detector chromatography indicated an 80% removal of organics, near that of the medium polarity compounds. Flame ionization detection indicated a 69% removal, similar to the total SEO removal. These methods may be useful as rapid and representative indicators of organic micropollutants in effluents and renovated waters. (Cassar-FRC)
W82-00123

**THE EFFECT OF CENTRIFUGATION ON THE SUSPENDED PARTICLES OF RIVER WATERS,**
Birzeit Univ., West Bank (Israel). Dept. of Chemistry.
R. Salim, and B. G. Cooksey.
Water Research, Vol 15, No 7, p 835-839, July, 1981. 3 Fig, 4 Tab, 9 Ref.

Descriptors: *Centrifugation, *Suspended solids, *Particle size, Particulate matter, Natural waters, Water analysis, Aggregates, *Clyde River, Galsgow, *Scotland.

Particle size distribution in water from the Clyde River, Glasgow, differed when measured by 2 methods: Coulter counter and centrifugation. This is probably due to agglomeration of fine particles during centrifugation. The weight and the surface area of particles separated by centrifugation at constant centrifugal force were linearly related to the reciprocal square root of time of centrifugation. Maximum efficiency of centrifugation to separate particles was 30 min at 5720 g centrifugal force and 22 min at 7000 g centrifugal force. About 90% by weight of particles 5 micrometers or larger in diameter were separated from the river water. The centrifugation method may be usable for separation of particulate matter in natural water samples to differentiate between labile and adsorbed trace metals. (Cassar-FRC)
W82-00124

**USE OF THE ELECTROLYTIC RESPIROMETER TO MEASURE BIODEGRADATION IN NATURAL WATERS,**
Procter and Gamble Co., Cincinnati, OH.
R. J. Larson, and R. L. Perry.
Water Research, Vol 15, No 6, p 697-702, June, 1981. 4 Fig, 4 Tab, 13 Ref.

Descriptors: *Biodegradation, *Surfactants, *Respirometer, Degradation, Natural waters, Measuring instruments, Fate of pollutants, Linear alkyl sulfonates, Alkylbenzene sulfonates, Ohio River.

The electrolytic respirometer was used to study the rate and extent of biodegradation of anionic, cationic, and nonionic surfactants in Ohio River water. The lowest concentration which could be tested was 5 mg per liter if the test material contained 60-80% carbon. Kinetics of oxygen uptake during degradation of the three surfactants studied, linear alkylbenzene sulfonate (LAS), cetyltrimethylammonium chloride (CTAC), and linear alcohol ethoxylate (LAE), were similar to those observed for glucose. Rates of LAE degradation were a saturable function of LAE concentration and did not increase proportionately with

concentration. CTAC degradation was a linear function of CTAC concentration, and saturation effects were not seen up to levels of 40 mg per liter. Beyond this point degradation decreased until 80 mg per liter, where it was totally inhibited. LAS degradation rates were proportional to concentration at 5 and 10 mg per liter and decreased sharply at 20 mg per liter. The surfactant was toxic to microorganisms at higher concentrations. If velocity curves are obtained, the rate data can be extrapolated to the lower surfactant concentrations normally encountered in natural waters. The electrolytic respirometer is useful to measure biodegradation of organic compounds where specific analytical methods are unavailable. (Cassar-FRC)
W82-00126

**GEOCHEMISTRY OF A SUBARCTIC SALT MARSH ENVIRONMENT,**
National Water Research Inst., Burlington (Ontario). Process Research Div.
For primary bibliographic entry see Field 2L.
W82-00148

**INTERFERENCE OF SULPHIDE IN INORGANIC PHOSPHATE DETERMINATION IN NATURAL WATERS,**
Nederlands Inst. voor Onderzoek der Zee, Texel.
V. N. De Jonge, and L. A. Villerius.
Marine Chemistry, Vol 9, No 3, p 191-197, June, 1980. 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Spectrophotometry, *Phosphates, *Chemical interference, *Sulfides, Water analysis, Antimony, Natural waters.

The interference of sulfide with the assay of inorganic phosphate is caused by antimony, one of the reagents. There can be various effects on the absorption spectrum, depending upon the concentrations of antimony and sulfide. Different antimony-sulfide compounds are formed, and the spectrum of phosphomolybdenum-antimony blue is replaced by that of pure phosphomolybdenum blue. The disturbance can be prevented through the method proposed by Murphy and Riley, which uses a higher antimony concentration. An antimony concentration of 100 micromol/liter makes the PO4-P determination independent of sulfide interference when applied to oceanic and coastal waters. If sulfide concentrations are expected to be higher than 200 micromol/liter, it is desirable to remove most of the sulfide by adding 1 ml of 6 N sulfuric acid to a 100 ml water sample, followed by bubbling with nitrogen for 15 min. (Small-FRC)
W82-00154

**SOLUTION SPECIES OF PLUTONIUM IN THE ENVIRONMENT,**
Battelle Pacific Northwest Lab., Richland, WA.
D. Rai, R. J. Serne, and J. L. Swanson.
Journal of Environmental Quality, Vol 9, No 3, p 417-420, July-September, 1980. 1 Fig, 2 Tab, 23 Ref.

Descriptors: *Plutonium, *Thermodynamics, Oxidation, Radioactive wastes, Adsorption, Precipitation, Environment, *Polutant identification.

Experimental data is presented that demonstrates the presence of Pu(V) in solutions in equilibrium with solid Pu(IV) hydroxide under conitions similar to those expected in the environment. The presence of Pu(V) in solutions contacting PuO2 is also inferred from the data. An Eh-pH diagram showing the stability fields of different solution species of Pu was developed. Recently evaluated thermodynamic data was used to develop the diagram. From this diagram it was concluded that the expected predominant species under relatively reducing environmental conditions would be Pu(III), and that Pu(V) would be the expected species to predominate under relatively oxidizing environmental conditions. Measurement was made of the Eh-pH values of 0.0015M calcium chloride solutions contacting Pu(IV) hydroxide and PuO2(s), they fell in or near the region of uncertainty between the calculated Pu(III) and Pu(V) stability fields. Solvent extraction tests were performed that demonstrated the absence of Pu(IV) in these solutions. Spectrophotometric tests demonstrated the absence of Pu(VI) in these solutions and indirectly demonstrated that Pu(V) was the predominant species. (Baker-FRC)
W82-00163

**PHOTOLYSIS OF N-NITROSODI-N-PROPYLAMINE IN WATER,**
Lilly Research Lab., Greenfield, IN.
For primary bibliographic entry see Field 5B.
W82-00164

**SORPTION-DESORPTION OF LINDANE BY ANAEROBIC AND AEROBIC SOILS,**
Central Rice Research Inst., Cuttack (India).
P. A. Wahid, and N. Sethunathan.
Journal of Agricultural and Food Chemistry, Vol 28, No 3, p 623-625, May/June, 1980. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Pesticides, *Sorption, Leaching, Soil properties, *Lindane, Agricultural chemicals, Organic compounds, Pokkali soils, Laterite soils, Alluvial soils, Rice, Flooding, Tropical regions.

Sorption of lindane by aerobic soils and by soils prereduced by 30-day flooding was studied. Three soil types were studied: alluvial, laterite, and pokkali. No increase in soil potentials occurred following 30 min of equilibration of anaerobic soils with lindane in the sealed system used. Anaerobic soils sorbed relatively less lindane than the aerobic soils. Alluvial soil, having the least organic matter content, showed the largest difference relative to organic matter, followed by laterite soil and organic matter-rich pokkali soil. To study desorption, lindane sorbed by 30-day flooded soils during 30 min of equilibration was desorbed by equilibrating with water for 30 min. During equilibration for desorption, the redox potentials increased from -60, -160, and -220 mV to 120, -10, and -220 mV in alluvial, laterite, and pokkali soils, respectively. However, these potentials were clearly lower than those of the respective aerobic soils, with values ranging from 200 to 260 mV. No appreciable difference in desorption occurred despite the state of redox conditions of the soils. As in aerobic soils, an inverse relation between organic matter and desorption of lindane was noted in anaerobic soils as well with least desorption from organic-matter-rich pokkali soil. It is suggested that the reduction of the soil following flooding does not affect its pesticide desorbing power. The decreased sorption of lindane by anaerobic soils may influence its bioactivity and environmental transport, especially in tropical rice growing areas with soils low in organic matter and high in iron oxides. (Baker-FRC)
W82-00189

**BACTERIAL CONTAMINATION OF DRINKING WATER SUPPLIES IN A MODERN RURAL NEIGHBORHOOD,**
Oregon State Univ., Corvallis. Dept. of Microbiology.
K. G. Lamka, M. W. LeChevallier, and R. J. Seider.
Applied and Environmental Microbiology, Vol 39, No 4, p 734-738, April, 1980. 1 Fig, 3 Tab, 27 Ref.

Descriptors: *Bacteria, *Drinking water, *Rural areas, Well water, Coliforms, Staphylococcus aureus, Water quality, Public health.

An intensive bacteriological investigation was made of the incidence, numbers, and bacterial species present in drinking water, primarily well water, in a rural community. Water serving 78 households was sampled on six occasions during a 15-month period. Water was tested for coliforms, fecal coliforms, Staphylococcus aureus, and standard plate count bacteria. On at least one occasion, more than one-third of the water supplies were judged unsatisfactory on the basis of standard plate counts over 10,000/ml and the presence of coliforms, fecal coliforms, and/or S. aureus. The most frequently isolated total coliforms were Citrobacter freundii, Klebsiella pneumoniae, and Escherichia coli. At least twelve other genera of bacteria were identified. Coliform contamination was higher after rainfall, while standard plate counts were higher during warm weather. The coliform contamination was probably due to leakage of surface water into improperly sealed wells while high standard plate counts may have resulted from the lack of chlorination to control microbial regrowth during warm weather. (Small-FRC)
W82-00198

**INFLUENCE OF ESTUARINE SEDIMENT ON VIRUS SURVIVAL UNDER FIELD CONDITIONS,**
Baylor College of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
R. L. LaBelle, and C. P. Gerba.
Applied and Environmental Microbiology, Vol 39, No 4, p 749-755, April, 1980. 3 Fig, 2 Tab, 25 Ref.

Descriptors: *Viruses, *Sediments, *Adsorption, *Estuaries, Canals, Seawater, Poliovirus, Field tests, Survival.

Field studies were performed to determine whether sediment exhibits a protective effect on virus survival, as it has in laboratory studies. Experiments were carried out in two canals exposed to sewage using two types of survival chambers: cellulose dialysis tubes or a plexiglass chamber designed to support diffusion membranes. Virus inactivation rates for poliovirus 1 and echovirus in seawater were similar for the two chambers. Virus adsorption to sediment greatly increased survival time. For virus adsorbed to sediment at a relatively nonpolluted site, the time required to inactivate 99% of poliovirus increased from 1.4 days to 6.0 days. At a more polluted site, poliovirus inactivation time was increased from about 1 h to 4.25 days by adsorption to sediment. Thus, virus association with estuarine sediment tends to prolong its survival in a seawater environment, and sediment analysis should be considered when determining viral populations. (Small-FRC)
W82-00199

**METHOD FOR RECOVERING VIRUSES FROM RIVER WATER SOLIDS,**
Environmental Monitoring and Support Lab., Cincinnati, OH.
G. Berg, and D. R. Dahling.
Applied and Environmental Microbiology, Vol 39, No 4, p 850-853, April, 1980. 5 Tab, 8 Ref.

Descriptors: *Suspended solids, *Rivers, *Viruses, Enteroviruses, Adsorption, Assay, Costs, Performance evaluation, Pollutant identification.

A method was developed for recovering poliovirus 1 that was adsorbed to river water solids. Small numbers of virions were eluted by mixing the solids for 30 min with a 10% solution of beef extract that contained sufficient Na2HPO4 to bring the molarity of the salt to 0.05 and sufficient citric acid to bring the pH to 7. Using this technique, many different enteroviruses have been recovered from river water solids. The method is not very practical when small numbers of viruses are to be recovered because it requires large numbers of cell cultures for assay. The organic flocculation technique of Katzenelson et al can be incorporated to save costs, but there is some loss of efficiency. Using the beef extract method, 39 to 63% of the polioviruses that had been adsorbed were recovered. A technique such as this is important because the number of virions recovered from solids in the river waters often exceeds the number recovered from the waters alone. (Small-FRC)
W82-00200

**COMPARISON OF NINE BRANDS OF MEMBRANE FILTER AND THE MOST-PROBABLE-NUMBER METHODS FOR TOTAL COLIFORM ENUMERATION IN SEWAGE-CONTAMINATED DRINKING WATER,**
Health and Welfare Canada, Ottawa (Ontario). Health Protection Branch.
R. S. Tobin, P. Lomax, and D. J. Kushner.
Applied and Environmental Microbiology, Vol 40, No 2, p 186-191, August, 1980. 3 Tab, 36 Ref.

Descriptors: *Monitoring, *Water quality, Filtration, *Membrane filters, Filters, Membrane proc-

esses, Chlorination, Drinking water, *Coliforms, Bacteria, Sewage bacteria, Wastewater pollution.

The possibility of significant differences existing among membrane filters in their ability to enumerate chlorine-stressed coliforms in sewage-contaminated drinking water was examined. Results obtained with the membrane filtration (MF) method are compared with those obtained by the most-probable-number (MPN) method. Aerated Ottawa tap water was used as the challenge water. To produce a sewage-contaminated water for test purposes, 2-10 ml of the supernatant of settled raw sewage was added to 6 liters of tap water to produce a total coliform density of 15,000 to 20,000 colonies/100 ml before chlorination. Chlorination of the contaminated samples was performed with the addition of 0.8 mg of available chlorine/liter using a contact time of 30 min at room temperature. Nine different brands of membrane filter were compared in the MF method. Significant differences were noted among membranes in four of the six experiments, with two-to four-times higher recoveries between the membranes at each extreme of recovery. When results from the membranes with the highest total coliform recovery rate were compared with the MPN results, the MF results were significantly higher in one experiment and equivalent to the MPN results in the other five experiments. A comparison was made of the species enumerated by these methods. In general the two methods enumerated a similar spectrum of organisms, with some indication that the MF method was subject to greater interference by Aeromonas. (Baker-FRC)
W82-00203

**DETERMINATION OF TRACE QUANTITIES OF DIMETHYLSULFOXIDE IN AQUEOUS SOLUTIONS,**
Florida State Univ., Tallahassee. Dept. of Oceanography.
M. O. Andreae.
Analytical Chemistry, Vol 52, No 1, p 150-153, January, 1980. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Water analysis, *Solvents, Organic compounds, *Dimethylsulfoxide, Sulfoxides, Industrial wastewaters, Rain, Photometry, Flame photometry, Gas chromatography.

The determination of dimethylsulfoxide (DMSO) at the nanogram level in aqueous solutions is described. After removal of dissolved volatile sulfur compounds by sparging with helium, DMSO is reduced to dimethylsulfide with sodium borohydride or chromium(II) chloride. The dimethylsulfide is stripped from the solution with a stream of helium and trapped on a chromatographic packing in a U-tube immersed in liquid nitrogen. After gas chromatographic separation from potentially interfering compounds, the dimethylsulfide is measured by a flame photometric sulfur detector and/or a flame ionization detector. The detection limit of the method is 1 ng S(DMSO) per sample, which corresponds to 0.02 micrograms S(DMSO)/liter. Precision is 5-10%, depending which variant of the method is used. The method has been used for the determination of DMSO in a variety of samples, including seawater, freshwater, rain, and phytoplankton culture solutions. DMSO appears to be a common constituent in natural waters. Its occurrence in seawater is restricted to the zone of light penetration. It may occur as an end product of algal metabolism. The occurrence of DMSO in rain may be due either to the release of this substance from the biosphere into the atmosphere or to the atmospheric oxidation of DMS to DMSO. (Baker-FRC)
W82-00205

**REDOX STABILITY OF INORGANIC ARSENIC(III) AND ARSENIC(V) IN AQUEOUS SOLUTION,**
North Dakota State Univ., Fargo. Dept. of Chemistry.
D. E. Tallman, and A. U. Shaikh.
Analytical Chemistry, Vol 52, No 1, p 196-199, January, 1980. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Arsenic, *Sample preservation, *Water analysis, Chemical analysis, Water sampling, Arsenicals, Arsenic compounds.

The stability of inorganic As(III) and As(V) in aqueous solution was re-examined. The findings indicate that solutions containing inorganic As(III) or (V) at ppb levels can be retained for at least three weeks without significant interconversion of As(III) and As(V) or loss of total arsenic. This conclusion pertained to water samples from natural sources as well as laboratory prepared standards. The samples were stored in glass with minimum precautions to exclude oxygen or other redox promoting contaminants. These findings are offered in argument against another report wherein it is stated that As(III) at the ppb level in aqueous solution undergoes a spontaneous oxidation to As(V) with essentially complete conversion occurring within one week for solutions less than 100 ppb in As(III). (Baker-FRC)
W82-00206

**MEASUREMENT OF THE SOLUBILITIES OF SLIGHTLY SOLUBLE ORGANIC LIQUIDS IN WATER BY ELUTION CHROMATOGRAPHY,**
National Bureau of Standards, Washington, DC. National Measurement Lab.
F. P. Schwarz.
Analytical Chemistry, Vol 52, No 1, p 10-15, January, 1980. 2 Fig, 4 Tab, 20 Ref.

Descriptors: *Organic compounds, *Solubility, Chemical analysis, *Chromatography, Water analysis, Water pollution control.

A solubility measurement method was examined which is simple and may well meet the ideal criteria of high sensitivity and nonspecificity needed to determine the solubilities of organic liquids in water. The method is based on liquid phase elution chromatography. The solute is the stationary phase, and water is the mobile phase. A transparent column is packed with an inert support coated with a known amount of the solute and then water is forced through the column. As the total volume of water flowing through the column increases, a solute depleted zone, different in color from the stationary phase, develops and increases in length. The solubility is calculated from the amount of solute removed from the column, i.e., the length of the solute depleted zone and the volume of water passed through the column. This method has been applied to the determination of ten different organic solutes to evaluate its sensitivity and specificity. In these determinations the method was shown to be nonspecific, sensitive to the ppm level, accurate, and fairly precise. (Baker-FRC)
W82-00207

**CONSECUTIVE AMPEROMETRIC TITRATIONS FOR CALCIUM AND MAGNESIUM,**
Allied Chemical Corp., Idaho Falls, ID.
L. L. Jackson, J. Osteryoung, J. O'Dea, and R. A. Osteryoung.
Analytical Chemistry, Vol 52, No 1, p 71-75, January, 1980. 3 Fig, 5 Tab, 17 Ref.

Descriptors: *Water analysis, *Metals, *Calcium, *Magnesium, Titration, Polarographic analysis, Chemical analysis.

A procedure is described for the measurement of both calcium and magnesium in a single aliquot. In this procedure the calcium is first titrated with ethylene glycol bis(beta-aminoethyl ether)-N,N,N,N'-tetraacetic acid (EGTA), and then magnesium is titrated with ethylenediaminetetraacetic acid (EDTA). 1,2-Diaminocyclohexane-N,N,N,N'-tetraacetic acid (DCTA) was also examined as a possible titrant for magnesium. The end point in each titration is determined by amperometric detection of the excess chelate at a dropping mercury electrode. Both the normal pulse and differential pulse amperometric modes were used, in contrast to the dc amperometric mode which has been employed in other work. The methods were tested at calcium and magnesium levels of 1-0.001 mF. Analyses were also done at ratios of calcium to magnesium from 100:1 to 1:100. These amperometric techniques were then applied to a variety of natural samples. It was found that copper and nickel could effectively be masked with tetraethylenetriamine (TRIEN), an excess of which did not have an adverse effect on the calcium and magnesium titrations in the normal pulse mode. The mode appears attractive for analysis of natural waters and other sample types, particularly in the automated mode. (Baker-FRC)
W82-00208

**A DIRECT DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRIC METHOD FOR THE DETERMINATION OF THALLIUM IN NATURAL WATERS,**
Geological Survey, Denver, CO.
J. E. Bonelli, H. E. Taylor, and R. K. Skogerboe.
Analytica Chimica Acta, Vol 118, No 2, p 243-256, August, 1980. 5 Fig, 4 Tab, 43 Ref.

Descriptors: *Thallium, *Water analysis, Chemical analysis, Surface water, Water pollution control, Fuel, Voltammetry, Anodes, Electrodes, Insecticides.

Routine thallium determinations in natural water samples submitted to the US Geological Survey Central Laboratory in Denver are being performed using a direct differential pulse anodic stripping voltammetric method (DPASV). This method requires no preconcentration, or at the most preconcentration for one hour and a sample volume of 25 ml, and provides a detection limit of 10 mg thallium per liter. This limit may be extended by appropriate alteration of experimental parameters or by the use of preconcentration steps. DPASV at the hanging mercury drop electrode and at the mercury film electrode is used in the concentration ranges 0.5-100 micrograms thallium per liter and 0.01-10 micrograms thallium per liter, respectively. Quantification is aided by the technique of standard additions. The response of the method is optimized for typical natural surface water matrices. An intercomparison of thallium determinations performed by the two anodic stripping methods and electrothermal-atomization atomic absorption spectrometry on normal and thallium-spiked surface water samples demonstrates equivalent accuracy within the range where atomic absorption is applicable. The method appears free from serious interferences. (Baker-FRC)
W82-00209

**IMPROVED METHOD AND TEST STRATEGY FOR RECOVERY OF ENTERIC VIRUSES FROM SHELLFISH,**
New Hampshire Univ., Durham. Dept. of Microbiology.
T. G. Metcalf, E. Moulton, and D. Eckerson.
Applied and Environmental Microbiology, Vol 39, No 1, p 141-152, January, 1980. 11 Tab, 24 Ref.

Descriptors: *Viruses, *Shellfish, Enteric bacteria, Filters, Enteroviruses, Membrane filters, Filtration.

A virus monitoring strategy is presented for recovery of enteric viruses from each of three commercially important shellfish species. The monitoring strategy includes the development of a single recovery method equally effective with oysters and hard- and soft-shell clams and identification of the test strategy needed for effective use of the improved method for recovery of low numbers of enteric viruses from each of these species. Effective recovery of virus depended as much upon details of the test strategy adopted for use of the improved method with each species as on the method itself. The most important test details involved sample composition, pool size, and method of use of cell culture. Recovery sensitivity measured permitted detection of 25 to 3 plaque-forming units of enteroviruses and 100 to 27 plaque-forming units of reovirus through their recovery in cell culture, with effectivenesses averaging 64 and 46%, respectively. Test samples prepared by the improved recovery method were virtually cytotoxicity free. Optimal recovery of virus on 45-square centimeter cell culture monolayers was obtained with 1-ml inocula adsorbed for 2 hr. The most effective recovery of virus from shellfish samples was made by a sequential adsorption procedure which allowed equal exposure to an entire

sample to each of two or more cell cultures. Removal of nonviral contaminants from test samples by antibiotic treatment was preferable to the use of ether or membrane filtration procedures. (Baker-FRC)
W82-00219

**ENUMERATION OF POTENTIALLY PATHOGENIC BACTERIA FROM SEWAGE SLUDGES,**
Texas Univ. Center for Applied Research and Technology at San Antonio.
D. J. Dudley, M. N. Guentzel, M. J. Ibarra, B. E. Moore, and B. P. Sagik.
Applied and Environmental Microbiology, Vol 39, No 1, p 118-126, January, 1980. 1 Fig, 5 Tab, 37 Ref.

Descriptors: *Bacteria, *Sludge, *Wastewater, Human diseases, *Land disposal, Salmonella, Staphylococcus, Mycobacterium, Shigella, Bacterial analysis, Sampling, Mixing.

Methodologies are presented that can provide quantitative data on the population densities in sludge of fluorescent Pseudomonas species, Staphylococcus, Mycobacterium, Clostridium, and Klebsiella, and semiquantitative data on Shigella and Salmonella. Enterobacteriaceae and oxidase-positive enteric organisms were quantitated using a multi-media rapid identification system. Determinations of routine indicator organisms were also performed on the sludges for the purpose of comparison with published studies on wastewater. Sludges used in the study were obtained from the Rilling Road Regional Wastewater Treatment Plant in San Antonio, Texas, as either primary or anaerobically digested sludges. Wasted secondary sludge samples from an activated sludge treatment process were collected at Kerrville, Texas. Bacterial surveys were performed on sludges undergoing land application at sites in the United States. The procedures compared included vortex mixing at high speed for 2 min of 20 ml of sludge containing about 1 g of sterile 3-mm glass beads in 50-ml centrifuge tubes, homogenization at high speed in a Waring blender, sonication at various wattage outputs, and direct plating without treatment. Sonication at all wattage levels was found to be bactericidal. Sludge sonicated at an output of 66 W yielded the highest recoveries from sludges that were sonicated. The best recovery of viable organisms was obtained in samples dispersed by vortex mixing with glass beads. Therefore, this method was selected as the sludge handling procedure before any bacterial analyses on subsequent sludge samples. (Baker-FRC)
W82-00221

**TECHNIQUE FOR DETERMINING TOTAL BACTERIAL VIRUS COUNTS IN COMPLEX AQUEOUS SYSTEMS,**
Clemson Univ., SC. Dept. of Microbiology.
D. L. Ewert, and M. J. B. Paynter.
Applied and Environmental Microbiology, Vol 39, No 1, p 253-260, January, 1980. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Viruses, *Isolation, Clarification, Bacteriophages, Sediments, *Activated sludge, Sludge, *Wastewater, Pollutant identification.

This paper describes an adaptation of the sedimentation technique of Sharp, performed so that total numbers of bacteriophages in samples from complex aqueous systems such as sewage, activated sludge mixed liquor, and bovine rumen fluid can be quantitated. All samples of sewage and activated sludge mixed liquor were obtained from Unit 1 of the Limestone Creek treatment plant at Gaffney, South Carolina. Sewage entering the plant was solely from domestic sources. Conditions for sample clarification, phage recognition, and recovery were optimized. In contrast to the plaque assay, this procedure permits quantitation of total numbers of phages, independent of bacterial host. Also, the modifications increase the sensitivity of the sedimentation assay, permitting detection of particles at a minimum concentration of 10,000 per ml. Maximal total phage concentrations in the aqueous phase of sewage and activated sludge mixed liquor were 1,300,000 and 4,300,000 per ml, respectively. This assay is the first one adapted for direct enumeration of total bacteriophages suspended in samples of unpurified aqueous ecosystems. (Baker-FRC)
W82-00222

**AUTOMATION OF WATER BACTERIOLOGICAL ANALYSIS: RUNNING TEST OF AN EXPERIMENTAL PROTOTYPE,**
Lille-1 Univ., Villeneuve d'Ascq (France).
P. A. Trinel, N. Hanoune, and H. Leclerc.
Applied and Environmental Microbiology, Vol 39, No 5, p 976-982, May, 1980. 6 Fig, 2 Tab, 9 Ref.

Descriptors: *Water quality, *Measuring instruments, Monitoring, Drinking water, Potable water, *Bacterial analysis.

An experimental apparatus is described which allows continuous and automatic bacteriological water examination. The apparatus ensures the analysis and detection of Escherichia coli by incubation of the water samples and then detection of glutamic acid decarboxylase in coils according to the Technicon principle. The analysis itself is rapid, taking less than 13 hr with a sensitivity of better than 1 bacterium/100 ml. A group of 120 samples of 100 ml of water can be examined in 24 hr. The device proved to be about as sensitive as conventional methods, with the observed differences arising from the low bacterial concentrations of the tested samples. The incubation coil made of Rilsan tubing ensured better flow stability than the usual glass coils and also permitted the removal of a great number of nipples, which could have been a possible source of contamination. Each week the culture coil should be cleaned with a sodium hypochlorite solution. Every three weeks the pump tubes should be replaced. Every month the ultrafiltration fibers should be changed. The phthalate-hydrochloric acid buffer decontamination method has proven to be very effective, always ensuring perfect integrity of the samples. The automatic device has the advantage of giving a much more representative sampling than is customarily obtained. The method costs about 75 cents per sample to run and allows rapid control of the treatment quality of water, as the analysis is carried out immediately in the treatment station. (Baker-FRC)
W82-00225

**DETERMINATION OF AMINOCARB IN WATER BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY,**
Department of the Environment, Moncton (New Brunswick). Inland Waters Directorate.
G. L. Brun, and R. M. MacDonald.
Bulletin of Environmental Contamination and Toxicology, Vol 24, No 6, p 886-893, 1980. 4 Fig, 2 Tab, 13 Ref.

Descriptors: *Aminocarb, *Pesticide residues, *Water analysis, Pollutant identification, Carbamate pesticides, Insecticides, *Gas liquid chromatography.

Residues of aminocarb (4-dimethylamino-3-methylphenyl N-methylcarbamate) in water were determined by reverse phase high performance liquid chromatography using ultraviolet absorbance (254 nm) with fluorescence detection (248 nm). The water samples were preconcentrated by pouring through Amberlite XAD-4 resin and eluting with ethyl acetate. After drying, the extract was concentrated to 5-10 ml and the solvent replaced with acetonitrile. In addition to aminocarb, some degradation products (carbamates and phenols) were included in the study to determine the feasibility of their identification and the degree of interference. Details on the overlapping and detection are discussed. Recoveries were 76% as determined with spiked lake water samples. Using a signal to noise ratio of 2:1, detection limits were 0.5 micrograms per liter and 0.05 micrograms per liter for UV absorption and fluorescence detection, respectively. Rain water samples analyzed by this method and by gas-liquid chromatography were in good agreement; samples contained from about 0.15 to 5 micrograms per liter aminocarb. Other carbamates which did not interfere with the analysis were propoxur, carbofuran, carbaryl, methiocarb, and mexacarbate. (Cassar-FRC)
W82-00232

**TRACE METAL GEOCHEMISTRY IN SEDIMENTS FROM THE MIRAMICHI ESTUARY, NEW BRUNSWICK,**
North Carolina Univ. at Wilmington. Department of Chemistry.
J. D. Willey, and R. A. Fitzgerald.
Canadian Journal of Earth Sciences, Vol 17, No 2, p 254-265, 1980. 5 Fig, 6 Tab, 27 Ref.

Descriptors: *Estuarine environment, *Trace elements, Manganese, Zinc, Lead, Copper, Minerals, Mine wastes, Urban drainage, Industrial wastes, Miramichi Estuary, New Brunswick, Canada, Trace metals, Bottom sediments.

Forty-six sediment samples were collected in May of 1976 from the Miramichi estuary. Three core samples were obtained from the river and estuary and three vibrocores from the estuary and Inner Bay in February of 1977. Concentrations of lignin-rich organic matter, up to 10% of the total sediment weight in the central estuary, correlated with analytical results for trace elements, which showed that more than 40% of the total Mn, Zn, and Cu is held in the oxidizable and organically-bound state. Mineralogical influences were most obvious in the river portion, where Mn concentrations averaged 695 micrograms/g, zinc averaged 282 micrograms/g, copper averaged 32 micrograms/g, and lead averaged 200 micrograms/g in the less than 63 micrometer size fraction of the sediments. Concentrations of all trace elements in the coarse fraction were considerably less as compared with the fine fraction. Very high organic carbon content was associated with sediments in which more than 25% of the Mn, Zn, and Cu was organically bound. When compared with sediments from other eastern Canada areas, the Miramichi sediments have at least twice the weak acid leachable Zn; this higher level of reactive metal is associated with high organic carbon content in the top 15 cm of the cored sediments. Suggested sources include mining activities as well as urban and industrial effluents. (Baker-FRC)
W82-00236

**A SALICYLATE-HYPOCHLORITE METHOD FOR DETERMINING AMMONIA IN SEAWATER,**
Sea Research Foundation, West Hartford, CT. Inst. for Aquarium Studies.
C. E. Bower, and T. Holm-Hansen.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 5, p 794-798, May, 1980. 3 Tab, 24 Ref.

Descriptors: *Ammonia, *Seawater, *Marine animals, Nitrogen compounds, Cultures, *Pollutant identification, Water analysis.

Total ammonia-N at levels of 10 to 1000 micrograms per liter in artificial seawater was determined by reaction of ammonia with sodium salicylate-sodium nitroprusside catalyst solution and sodium hypochlorite to produce indophenol blue. Absorbances were measured by spectrophotometer at 640 mm. The salicylate-hypochlorite method and the phenol-hypochlorite method showed excellent agreement at levels of 10 to 500 micrograms per liter of ammonia-N. Coefficients of variation for samples containing 25 or more micrograms per liter of ammonia-N were less than 3% for the salicylate method. Since sodium salicylate is light sensitive and samples should be read within three hours, the method may not be suitable for field use. The characteristic color produced by the reagent permits visual estimates of the ammonia levels in culture systems. Zero level ammonia produces a light yellow; 100 micrograms per liter, green; and 1000 micrograms per liter, blue, with gradations of color between. (Cassar-FRC)
W82-00238

**ISOLATION OF METHANOBACTERIUM BRYANTII FROM A DEEP AQUIFER BY USING A NOVEL BROTH-ANTIBIOTIC DISK METHOD,**

Geological Survey, Menlo Park, CA. Water Resources Div.
E. M. Godsy.
Applied and Environmental Microbiology, Vol 39, No 5, p 1074-1075, May, 1980. 13 Ref.

Descriptors: *Bacteria, *Aquifers, Methanogenesis, Measuring instruments, Cultures, Water treatment facilities, Wastewater treatment, Wells, Pollutant identification.

A method for the isolation of a methanogenic bacterium from a mixed culture using a complex growth medium supplemented with antibiotic susceptibility disks is presented. The disk medium was prepared by adding from one to five antibiotic susceptibility disks to tubes of sterile broth medium in serum tubes capped with black rubber stoppers and crimped with aluminum seals. Tubes of sterile broth medium were inoculated with water samples obtained from wells located on the grounds of the West Palm Beach Regional Water Pollution Control Plant. The wells extended 657 to 673 meters below the land surface and flowed freely under an artesian head. After inoculation, the gas phase in each tube was exchanged for a pressurized atmosphere of 80% hydrogen and 20% carbon dioxide. The tubes were incubated at 30 degrees C for 4 weeks. The presence of methane in the headspace was monitored periodically by a gas chromatograph fitted with thermal conductivity detectors and a Poropak Q column. Total methane production in the headspace after 3 days averaged 1.2 micromol in all tubes except those containing chloramphenicol. No methane or cellular growth was noted in chloramphenicol containing medium after 21 days. Total methane production in the headspace averaged 76 micromol in all growth-supporting media after 7 days of growth. After antibiotic treatment, enrichment of fluorescent bacteria was noted in all media, but only in the presence of cephalothin (6-30 micrograms/ml) and clindamycin (1.6 and 2.0 micrograms/ml) was it noted that the cultures contained only fluorescing cells. The broth-antibiotic disk method offers a means by which methanogenic bacteria can be easily isolated from mixed cultures of bacteria. (Baker-FRC)
W82-00240

**CONCENTRATION OF POLIOVIRUS IN WATER BY MOLECULAR FILTRATION,**
Environmental Monitoring and Support Lab., Cincinnati, OH.
D. Berman, M-E. Rohr, and R. S. Safferman.
Applied and Environmental Microbiology, Vol 40, No 2, p 426-428, August, 1980. 3 Tab, 11 Ref.

Descriptors: *Viruses, *Filtration, Water quality, Water treatment, *Wastewater treatment, Poliovirus.

The efficiency of concentrating poliovirus 1 from distilled water samples was determined by using a recirculating-flow molecular filtration system. The molecular filtration unit was equipped with two PT series membranes which had a total surface area of 920 square centimeters and a nominal molecular weight limit of either 10,000 or 100,000. Two of the four ports connected to the manifold of the unit served as filtrate outlets. The sample-retentate flow, to and from the unit, was through the remaining two ports. Virus feed samples at a final concentration of 1 to 10 plaque-forming units per ml were prepared by rapidly mixing poliovirus 1 (Mahoney LP) in 2- or 4-liter volumes of distilled water. Initially, membranes with a 100,000 nominal molecular weight limit were used. Virus recoveries in this system after 23- to 46-fold concentrations averaged only 10.5%, and less than 1% of the unaccounted-for virus was present in the filtrate. To check the possibility that virus was nonreversibly adsorbed on the membranes, single runs were made in which 1% glycine was used either to pretreat the membrane or to supplement the feed. Either treatment resulted in the apparent blockage of virus adsorption sites. When these treatments were combined, the average recovery of virus increased to 39.0%. Upon pretreatment with flocculated beef extract, a nearly five fold increase in virus recovery was noted. At the same time the number of virions passing into the filtrate averaged 20.4% of the total viral input. The results of the study indicate that the described molecular filtration system can effectively concentrate viruses from water, provided membranes are pretreated with flocculated beef extract. Clarification may be needed for water containing suspended particles larger than 10 micrometers. (Baker-FRC)
W82-00246

**CONCENTRATION OF COLIPHAGES FROM LARGE VOLUMES OF WATER AND WASTEWATER,**
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
S. M. Goyal, K. S. Zerda, and C. P. Gerba.
Applied and Environmental Microbiology, Vol 39, No 1, p 85-91, January, 1980. 10 Tab, 35 Ref.

Descriptors: *Bacteria, *Filters, Drinking water, Wastewater, Measuring instruments, Secondary treatment, Natural waters, Water quality, Coliphages.

An evaluation was made of the positively charged filters used for concentrating coliphages from sewage and tap water, and they were compared with negatively charged filters. Four different coliphages were studied. Positively charged microporous filters were found to efficiently adsorb these coliphages from tap water, sewage, and lake water at neutral pH. Adsorbed viruses were eluted with a 1:1 mixture of 8% beef extract and 1 M sodium chloride at pH 9. Using this method, coliphages could be concentrated from 17-liter volumes of tap water with recoveries ranging from 34 to 100%. Coliphages occurring naturally in raw and secondarily treated sewage were recovered with average efficiencies of 56.5 and 55.0%, respectively. This method should be useful in isolating rare phages, studying the ecology of phages in natural waters, and evaluating water quality. (Baker-FRC)
W82-00247

**ENUMERATION AND RELATIVE IMPORTANCE OF ACETYLENE-REDUCING (NITROGEN-FIXING) BACTERIA IN A DELAWARE SALT MARSH,**
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 2L.
W82-00248

**TEMPORAL VARIATIONS IN TRIHALOMETHANE CONTENT OF DRINKING WATER,**
Texas Univ. Health Science Center, Houston. Dept. of Environmental Sciences.
V. L. Smith, I. Cech, J. H. Brown, and G. F. Bogdan.
Environmental Science and Technology, Vol 14, No 2, p 190-196, February, 1980. 8 Fig, 1 Tab, 14 Ref.

Descriptors: *Drinking water, *Organic compounds, *Trihalomethanes, Chemical analysis, Water analysis, Timing, Variability.

The importance of temporal and spatial aspects in environmental monitoring of drinking water is stressed. Trihalomethane concentrations were measured every 4 hours for 7 days at a site within the University of Texas Health Science Center. This site is representative of a moderate size office building housing a population of about 750 persons during working hours and minimally staffed at night. The 24-hr variations in concentrations of total trihalomethanes, chloroform, dichlorobromomethane, dibromochloromethane and bromoform in drinking water were assessed in a dynamic system using a solvent-extraction electron-capture gas chromatographic procedure. Spectral analysis and replicate harmonic regression were used to evaluate temporal patterns in fluctuations of the trihalomethanes. Data indicate that for reliable monitoring the time of sampling is an important factor. Both within the 24 hr period and in day to day samples, variations in the results were clearly evident. Naturally, these findings have a bearing on the predictability of trihalomethane concentrations in drinking water. (Baker-FRC)
W82-00255

**IDENTIFICATION OF ORGANIC COMPOUNDS IN A MUTAGENIC EXTRACT OF A SURFACE DRINKING WATER BY A COMPUTERIZED GAS CHROMATOGRAPHY/MASS SPECTROMETRY SYSTEM (GC/MS/COM),**
Health Effects Research Lab., Cincinnati, OH.
W. E. Coleman, R. G. Melton, F. C. Kopfler, K. A. Barone, and T. A. Aurand.
Environmental Science and Technology, Vol 14, No 5, p 576-588, May, 1980. 3 Fig, 1 Tab, 34 Ref.

Descriptors: *Organic compounds, *Trace levels, *Water analysis, *Drinking water, Mutagenesis, Gas chromatography, Polychlorinated biphenyls, Aromatic compounds, Amines, Chlorinated hydrocarbons, Pollutant identification, Reverse osmosis, Mass spectrometry.

Reverse osmosis and lyophilization were used to concentrate organic compounds from drinking water in Cincinnati, Ohio. The diethyl ether soluble extract of this concentrate, which was mutagenic according to the Ames test, was partitioned into acid and base/neutral fractions. Computerized gas chromatography/mass spectrometry was used to analyze the following: original concentrate, acid fraction, methylated acid fraction, unpartitioned base/neutral extract, and 5 base/neutral eluants from silica gel partitioning. Polychlorinated biphenyls (PCB) and chlorinated aromatics were found in the second base/neutral fraction, and polynuclear aromatic hydrocarbons in the fourth base/neutral fraction. Altogether, 460 organic compounds were identified: 41 polynuclear aromatics, 15 PCBs, ketones and aldehydes (C3 to C20), alcohols (C3 to C19), ethers (C3 to C12), acids (C2 to C20), esters and lactones (C2 to C26), nonaromatic hydrocarbons (C2 to C26), phthalates and anhydrides (C8 to C28), and compounds containing halogens, sulfur, phosphorus, and nitrogen. (Cassar-FRC)
W82-00256

**GAS CHROMATOGRAPHIC DETERMINATION OF SELENIUM (-II, O), -(IV), AND -(VI) IN NATURAL WATERS,**
Okayama Univ. (Japan). Dept. of Chemistry.
H. Uchida, Y. Shimoishi, and K. Toei.
Environmental Science and Technology, Vol 14, No 5, p 541-544, May, 1980. 6 Fig, 4 Tab, 6 Ref.

Descriptors: *Selenium, *Water analysis, *Metals, Pollutant identification, *Gas chromatography, Natural waters, Seawater, Trace metals.

Selenium in river water and seawater was determined by electron capture detection gas chromatography using 1,2-diamino-3,5-dibromobenzene. This reagent reacts only with Se(4+) to form 4,6-dibromopiazselenol, which is extracted into toluene and determined by gas chromatography. Se(2-) and Se(0) are oxidized by Br to Se(4+); Se(6+) is reduced by a bromine-bromide solution to Se(4+). The Se(4+) is detected, and the amounts of Se in different oxidation states calculated by difference. The lower limit of the method is 2 ng per liter. The seawater samples tested contained 50-70 ng per liter Se, and river water, 16-230 ng per liter. River water contains more Se(2-) and Se(0) and less Se(6+) than seawater. (Cassar-FRC)
W82-00257

**DETERMINATION OF ORGANICALLY COMBINED CHLORINE IN HIGH MOLECULAR WEIGHT AQUATIC ORGANICS,**
Minnesota Univ., Minneapolis. Dept. of Chemistry.
M. P. McCahill, L. E. Conroy, and W. J. Maier.
Environmental Science and Technology, Vol 14, No 2, p 201-203, February, 1980. 5 Tab, 10 Ref.

Descriptors: *Chlorine, *Water analysis, Chemical analysis, Organic compounds, *Chlorination, Disinfection, Water treatment.

A method to determine total organic chlorine content of high molecular weight aqueous organic mixtures by photochemical mineralization was developed. In chlorinated sewage effluent total organic chlorine was found to increase after chlorination, so that from 0.002 to 0.009 ml of total organic chlorine per mol of total organic carbon

was present. Thus, chlorination of sewage effluents was shown to produce small amounts of organochlorine compounds of molecular weight greater than 1000 as defined by ultrafiltration of the sample. In its present form, this method is not sufficiently sensitive to detect total organic chlorine in unpolluted waters. However, sensitivity can be increased in principle to any desired level by more extensive preconcentration of the sample. In this method total organic chlorine is measured after preconcentrating the sample, photolyzing the organics to mineralize the chlorine, and measuring inorganic chloride. (Baker-FRC)
W82-00258

**CONCENTRATION OF SEEDED SIMIAN ROTAVIRUS SA-11 FROM POTABLE WATERS BY USING TALC-CELITE LAYERS AND HYDROEXTRACTION,**
Ottawa Univ. (Ontario). Dept. of Microbiology and Immunology.
S. Ramia, and S. A. Sattar.
Applied and Environmental Microbiology, Vol 39, No 3, p 493-499, March, 1980. 6 Tab, 38 Ref.

Descriptors: *Drinking water, *Water pollution control, Monitoring, Rotavirus, Viruses, Human diseases, *Pollutant identification, Tal-Celite adsorption, Polyethylene glycol.

The combined use of talc-Celite adsorption and polyethylene glycol 6000 hydroextraction was tested for its efficiency in preparing water samples to analyze for possible rotavirus contamination. The water to be sampled was seeded with simian rotavirus SA-11 and MA-104 cells. The dechlorinated tap water samples were adjusted to pH 6.0, and addition of Earle balanced salt solution was made to a final concentration of 1:100. Passage of a one liter volume of such a sample through a layer containing a mixture of talc (300 mg) and Celite 503 (100 mg) led to the adsorption of nearly 93% of the added SA-11 plaque-forming units. For the recovery of the layer-adsorbed virus, 3% beef extract and 1x tryptose phosphate broth were found to be superior to a variety of other eluents tested. When the 100 liter sample volumes were tested, layers containing 1.2 g talc and 0.4 g Celite were used. Virus elution was conducted with 100 ml of tryptose phosphate broth. The eluate was concentrated 10-fold by overnight hydroextraction at 4 degrees C with polyethylene glycol. With total virus inputs of 7.0 x 10 to the fifth power and 1.4 x 10 to the second power plaque-forming units, the recoveries were about 71% and 59%, respectively. The use of this combination of techniques may be of use to detect the presence of rotavirus contamination in drinking water, and thus may be helpful in controlling outbreaks of rotavirus gastroenteritis. (Baker-FRC)
W82-00272

**EVALUATION OF METHODOLOGIES FOR THE DETERMINATION OF ACUTE TOXICITY IN PULP AND PAPER EFFLUENTS,**
Institute of Paper Chemistry, Appleton, WI.
E. F. Zanella, and S. A. Berben.
Tappi, Vol 63, No 3, p 77-82, March, 1980. 1 Fig, 6 Tab, 21 Ref.

Descriptors: *Bioassay, *Fish, *Pulp and paper industry, Pollutant identification, Water pollution effects, Toxicity, Fathead minnows, Daphnia, Caddisflies, Larvae, Testing procedures, Pulp wastes, Effluents, Industrial wastes, Sulfites.

Acute toxicity bioassays for pulp and paper mill effluents were evaluated in a multiple-parameter testing program using treated and untreated samples of unbleached kraft, bleached sulfite, and bleached kraft mill effluent. Test organisms included fathead minnows (Pimephales promelas), Daphnia (Daphnia magna), and caddis fly larvae (Hydropsyche sp.). There was no appreciable difference in the LC50 values from the following fish tests: dynamic, 24-hour replacement, and static bioassays. The 12-hour replacement fish bioassay gave comparable results but was more variable. The residual oxygen assays did not coincide with LC50 values from standard tests and failed to produce a response to several of the toxic effluents tested. The relative sensitivity of Daphnia, caddis fly larvae, and fathead minnows was consistent for different samples of the same effluent type but different for different effluents. Daphnia were sensitive to bleached sulfite effluents but resistant to bleached kraft mill effluent. Caddis fly larvae was the least sensitive of the test organisms used. (Cassar-FRC)
W82-00297

**SHALLOW CORE SNOW CHEMISTRY OF ATHABASCA GLACIER, ALBERTA,**
New Hampshire Univ., Durham. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2C.
W82-00320

**DISTRIBUTION OF OBLIGATELY OLIGOTROPHIC BACTERIA IN LAKE BIWA,**
Kyoto Univ. (Japan). Dept. of Fisheries.
Y. Ishida, K. Shibahara, H. Uchida, and H. Kadota.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 46, No 9, p 1151-1158, 1980. 7 Fig, 2 Tab, 14 Ref.

Descriptors: *Oligotrophy, *Bacteria, *Aquatic microorganisms, *Lake Biwa, Japan, Lakes, Epilimnion, Hypolimnion, Bioindicators, Water pollution effects.

The NPN-C14-substrate method was used to investigate seasonal changes and vertical and horizontal distributions of oligotrophic bacteria in Lake Biwa, Japan. In unpolluted areas the ratio of obligate oligotrophic bacteria to total heterotrophic bacteria was 50%, and in moderately polluted waters 15%, while in heavily polluted waters none were detected. The vertical distribution was studied in unpolluted waters. At the thermocline the ratio of total oligotrophs to total heterotrophs was lowest, and eutrophs were predominant. In the epilimnion, proportions were very variable; there was less variability in the hypolimnion. During three periods of algal bloom no obligate oligotrophs were detected in the water. There were large populations present in unpolluted water from late May to early autumn. (Cassar-FRC)
W82-00346

**DISTRIBUTION OF CLOSTRIDIUM BOTULINUM,**
Technical Univ. of Denmark, Lyngby. Technical Lab.
H. H. Huss.
Applied and Environmental Microbiology, Vol 39, No 4, p 764-769, April, 1980. 3 Tab, 31 Ref.

Descriptors: *Clostridium botulinum, *Distribution patterns, *Aquatic environment, *Bacteria, Soil bacteria, Aquatic bacteria, Microbiological studies, Sediments.

The incidence and distribution of C. botulinum in the soil, freshwater sediments, and marine environments of Denmark, the Faroe Islands, Iceland, Greenland, and Bangladesh were determined. Six hundred eighty-four samples were tested. Type E was found in 90% of the Danish aquatic samples and in 86% of the marine samples from Greenland. Type E was not present in Danish cultivated soils and woodland soils, but Type B was frequently found in these environments. Types A, B, or E were present in 2.6% of the samples collected in the Faroe Islands and Iceland, and Types C and D were found in 42% of the Bangladesh samples. Neither general industrial pollution nor a high rate of rotting vegetation was related to the incidence of Type E. Presence of fish or a rich aquatic fauna did appear to be related to a high incidence of Type E. Type E may be a true aquatic organism, because its environment offered the best conditions for spore survival. (Small-FRC)
W82-00349

**ANALYTICAL METHODS EVALUATION FOR APPLICABILITY IN LEACHATE ANALYSIS,**
Washington Univ., Seattle.
F. B. DeWalle, T. Zeisig, J. F. C. Sung, D. M. Norman, and J. B. Hatlen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-172306, Price codes: A15 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-046, May 1981. 4 p, 3 Tab.

Descriptors: *Leachates, *Pollutants, *Water analysis, Physical properties, Chemical properties, Organic compounds, Cations, Anions, Variation coefficient, Statistical analysis, Precision, *Pollutant identification.

Thirty-two laboratories in the United States and Canada conducted round-robin analyses of leachate samples. Ten samples from nine locations and one spiked sample were analyzed for up to 28 parameters to evaluate accuracy and precision of the methods employed. The 28 parameters included physical parameters (pH, oxidation reduction potential, conductivity, turbidity, and solids), organics (chemical oxygen demand, total organic carbon, organic nitrogen, and free volatile fatty acids), anions (sulfate, phosphate, chloride, nitrate, and bicarbonate), and cations (alkali metals, alkaline earth metals, transition metals, and heavy metals). Individual parameter coefficients of variation ranged from 32% for COD to 210% for cadmium. Significant differences were noted between results from colorimetric methods and from titrimetric and physical methods. The between-laboratory component of variation was larger than the within-laboratory component. The average recovery for spiked parameters varied widely for individual parameters. The most applicable method for analysis of each parameter is recommended. Use of the standard addition technique is required in each laboratory to determine the matrix depression or enhancement for each type of leachate sample. The accuracy (agreement between measured and actual amounts) and the precision (reproducibility) of different analytical methods were evaluated in depth. (Brambley-SRC)
W82-00380

**METHODS FOR LEVEL 2 ANALYSIS BY ORGANIC COMPOUND CATEGORY,**
Little (Arthur D.), Cambridge, MA.
K. E. Thrun, J. C. Harris, C. E. Rechsteiner, and D. J. Sorlin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-179855, Price codes: A14 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S7-81-029, July 1981. 3 p, 3 Ref.

Descriptors: *Effluents, *Industrial wastes, *Organic compounds, *Chemical analysis, Gas chromatography, Mass spectrometry, Pollutants, Environmental effects.

As a step in the development of a general methodology for chemical and biological assessment of environmental effects of industrial effluents, specific detailed methods for analysis of organic chemicals in particular compound categories were evaluated. This supplements the earlier Level 2 Procedures manual and provides an initial experimental data base as a resource for laboratories undertaking Level 2 studies. Methods were evaluated using sets of model compounds spanning a range of molecular weights and boiling points in each category. Evaluation criteria included: detection limit, retention time, chromatographic resolution, and precision and accuracy of the methods. Specific detailed Level 2 methods have been recommended for 25 categories of organic compounds. Most of the primary recommendations are based on packed column gas chromatography/mass spectrometry, with alternative procedures suggested where appropriate for particular sample matrices or compound types. Level 2 inquiries are expected to be directed primarily at the identification quantification, and confirmation of specific compounds whose presence could be inferred on the basis of the categorical analysis of Level 1. (Moore-SRC)
W82-00384

**THE ANALYSIS OF OIL SHALE WASTES: A REVIEW,**
Denver Univ., CO. Charles H. Prien Center for Synthetic Fuel Studies.
J. R. Wallace.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-190522, Price codes: A13 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S7-81-084, July 1981. 4 p, 1 Tab.

Descriptors: *Oil shale, *Industrial wastewater, *Chemical analysis, *Wastewater analysis, Hydrogen ion concentration, Conductivity, Ammonia, Ammonium, Sulfur compounds, Organic compounds, Dissolved solids.

The current status of methods for chemical analysis of oil shale effluents was studied in order to provide a reference for those who must measure and control the effects of oil shale waste products on the environment. The effluents studied include spent and raw shale, process waters of various types, retort gas and burned fuel gas. Methods were considered for the measurement of trace and minor elements, dissolved ions, organic compounds, sulfur and nitrogen species of environmental importance, and physical properties such as dissolved solids. When analytical methods developed for simple, homogeneous material are applied to complex samples like oil shaleeffluents, extraordinary interferences or matrix effects can render the method ineffective. Methods for determining pH, conductivity, fluorine, ammonium and ammonia have been shown to be adequate for a limited number of wastewaters. Methods for other dissolved inorganics such as chloride, phosphate, total phosphorus, and sulfur oxides either lack confirmation or have been shown to be inaccurate. Quality assurance is of utmost importance when dealing with analytical methods for the chemical determination of oil shale samples. (Moore-SRC)
W82-00388

**A BACTERIAL BIOASSAY FOR ASSESSMENT OF WASTEWATER TOXICITY,**
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
K. J. Williamson, and D. G. Johnson.
Water Research, Vol 15, No 3, p 383-390, March, 1981. 8 Fig, 24 Ref. OWRT-A-036-ORE(2), 14-34-0001-6038.

Descriptors: *Bioassay, *Bacteria, Toxicity, Nitrogen fixing bacteria, Microorganisms, Nitrification, Wastewater analysis, Biological properties, Pollutant identification.

A bioassay technique using freeze-dried Nitrobacter as the test organism was applied to the analysis of a wastewater treatment system at a fiberboard plant near Portland, Oregon. Treatment facilities on site consist of settling ponds, activated sludge basin, clarifier and holding ponds. The treated water is recycled to the mill for reuse. Soluble and particulate organics began accumulating in the system when the removal of BOD dropped significantly. Both the influent and effluent flows were determined by this method to be toxic. This toxicity spread throughout the entire wastewater treatment system. Toxicity tests were conducted, but no single agent could be identified as the cause of the problem. Various physical and chemical methods were used to treat the situation. It was concluded that the Nitrobacter bioassay meets criteria for a bioassay of industrial and municipal wastewater and is simple and inexpensive for environmental source sampling. The bioassay is a sensitive indicator of toxicity in biological wastewater treatment and can be used to identify toxic wastewater sources and to evaluate treatment and control technologies. (Baker-FRC)
W82-00398

**A RESONANCE RAMAN METHOD FOR THE RAPID DETECTION AND IDENTIFICATION OF BACTERIA IN WATER,**
Rhode Island Univ., Kingston. Dept. of Chemistry.
W. F. Howard, W. H. Nelson, and J. F. Sperry.
Applied Spectroscopy, Vol 34, No 1, p 72-75, January/February, 1980. 4 Fig, 3 Tab, 24 Ref. OWRT-B-078-RI(2).

Descriptors: *Water analysis, *Bacteria, Water quality control, Resonance, *Spectroscopy, Raman spectroscopy, Pollutant identification.

This study demonstrates that a substantial number of carotene-containing bacteria and algae produce specific, interpretable resonance Raman spectra when irradiated at 488.0 and 514.5 nm. Further, these spectra are easily obtained using simple sample preparation techniques. Spectra are of high quality and are reproducible. Such spectra may be suitable for rapid identification of bacteria even in the presence of substantial amounts of organic material. A total of 16 types of carotene-containing bacteria and algae were studied. Most of the information was contained in the 900 to 1600/cm region. Several bacteria exhibited pronounced carotenoid overtone and combination bands which could be assigned along with the fundamental vibrations. (Baker-FRC)
W82-00404

**RADIONUCLIDE CONCENTRATIONS IN STREAMS IN THE UPPER BLACKFOOT RIVER BASIN, SOUTHEASTERN IDAHO,**
Geological Survey, Boise, ID. Water Resources Div.
W. H. Low.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.00 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 81-142 (WRI), March 1981. 17 p, 2 Fig, 1 Plate, 4 Tab, 15 Ref.

Descriptors: *Surface water, *Water quality, *Pollutant identification, *Mine drainage, Streams, Overburden, Bottom sediments, Suspended sediments, Phosphates, Uranium, Sampling, Water analysis, Water quality standards, Geochemistry, Path of pollutants, *Idaho, Southeastern Idaho, Blackfoot River basin, Radium, *Phosphate mining, *Radionuclides.

Data on radionuclide concentrations in water and sediment material in the phosphate-mining area of the upper Blackfoot River basin were collected from May to October 1979. Maximum measured uranium and radium-226 concentrations dissolved in water were 3.7 micrograms per liter and 1.8 picocuries per liter, respectively. Maximum measured uranium and radium-226 concentrations in stream-bottom material were 5.5 micrograms per gram and 1.8 picocuries per gram, respectively. Maximum measured uranium and radium-226 concentrations on bottom material were 9.9 micrograms per gram and 3.9 picocuries per gram, respectively, in sediment-retention ponds, and 17 micrograms per gram and 3.5 picocuries per gram, respectively, in a mine pit. Maximum observed radon-222 concentration was 120 picocuries per liter in surface water and averaged 550 picocuries per liter at Formation Springs (site 10). All radionuclide concentrations were within existing State and Federal water-quality standards. Radionuclide concentrations were not significantly increased downstream from active mining sites. (USGS)
W82-00418

**COMPARATIVE STUDY ON ORGANIC CONSTITUENTS IN POLLUTED AND UNPOLLUTED INLAND AQUATIC ENVIRONMENTS. II. FEATURES OF FATTY ACIDS FOR POLLUTED AND UNPOLLUTED WATERS,**
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
G. Matsumoto.
Water Research, Vol 15, No 7, p 779-787, July, 1981. 2 Fig, 3 Tab, 25 Ref.

Descriptors: *Fatty acids, *Water analysis, Pollutant identification, Organic acids, Organic compounds, Natural waters, Rivers, Tokyo, Ogasawara Islands, Japan.

There was no marked difference between the fatty acid constituents of polluted rivers in the Tokyo area and unpolluted waters from the Ogasawara Islands. The predominant fatty acids in both types of water were even carbon chains in the lower molecular weight ranges, C13 to C19. Straight chain, unsaturated, and branched acids from C8 to C34 were detected. Tokyo waters contained total fatty acids at 270 + or - 120 micrograms per liter; fatty acids as carbon/total organic carbon, 2.6 + or - 0.93%; and fatty acids as carbon/ethyl acetate extractable organic carbon, 16 + or - 6.7%. Similar values for the Ogasawara Islands water were lower, 58 + or - 29 micrograms per liter, 0.79 + or - 0.48%; and 2.1 + or - 0.51%, respectively. Over 95% of the fatty acids were in particulate fractions. Levels of combined fatty acids were twice as great as those of free fatty acids. Unsaturated fatty acids were found only in the combined form. (Cassar-FRC)
W82-00454

**APPLICATION OF A MULTIPLE ALGINATE FILTER METHOD FOR THE DETERMINATION OF WATER VIRUSES CONCENTRATION (CONCEPTION D'UNE MEMBRANE FILTRANTE A BASE D'ALGINATE POUR LA CONCENTRATION DES VIRUS HYDRIQUES),**
Ecole Polytechnique, Limoges (France).
P. La France, A. J. Drapeau, and E. Kurstak.
Water Research, Vol 15, No 6, p 713-718, June, 1981. 2 Fig, 2 Tab, 16 Ref.

Descriptors: *Viruses, *Membrane filters, *Filtration, *Pollutant identification, Water treatment, Alginate filters, Water analysis, Gels.

Alginate gels were modified by additives to improve the filtration characteristics for concentrating viruses from large water samples. The filtering capacity of the pure 0.5% alginate unitary membranes increased directly with an increase in intramembrane concentrations of sodium gluconate. The filtration output of pure 0.75% alginate membranes remained constant for intramembrane Tween 80 concentrations of less than 0.5%. The existence of a stratified membrane (alginate-sodium gluconate and alginate-Tween 80) was recognized. The double membrane (sample volume, 5 liters) with or without 0.75% gluconate permitted no poliovirus to enter the filtrate. The unitary membranes (sample volume 10 liters), 0.5% and 0.75%, with and without sodium gluconate or Tween 80, had between 12.6% and 89.0% virus in the filtrate. (Cassar-FRC)
W82-00458

**NITROSAMINES IN TAP WATER AFTER CONCENTRATION BY A CARBONACEOUS ADSORBENT,**
Science and Education Administration, Philadelphia, PA. Eastern Regional Research Center.
W. I. Kimoto, C. J. Dooley, J. Carre, and W. Fiddler.
Water Research, Vol 15, No 9, p 1099-1106, September, 1981. 1 Fig, 7 Tab, 15 Ref.

Descriptors: *Nitrosamines, *Water analysis, *Carcinogens, Amines, Nitrogen compounds, *Drinking water, Adsorption, Ion exchange resins, Activated carbon, Pollutant identification.

Volatile nitrosamines were determined in municipal tap water using Ambersorb XE-340, a carbonaceous adsorbent. Between 58 and 99% of seven added nitrosamines were removed from spiked distilled water samples. Analysis of tap water (flow rate through the adsorbent, 1.2 liters per hour) showed the following levels of nitrosamines, in micrograms per liter: N-nitrosodimethylamine, 0.003-0.006; N-nitrosmorpholine, 0.006-0.016; and N-nitrosodiethylamine, traces. When low levels of secondary amines were added to tap water, nitrosamines were detected, indicating that the water had nitrosating ability. Experimental evidence obtained by adding sulfamic acid, piperidine, and sodium sulfite to the water showed that the nitrosamines did not form on the resin. It was proposed that the trace nitrosamines may have been produced from the reaction of nitrates (present at levels up to 10 micrograms per liter N02-N) with an oxidizing agent, such as chlorine, and amines in the water. (Cassar-FRC)
W82-00459

**TESTING THE FLOCCULATION/COAGULATION OF WASTEWATER BY GRANULOMETRIC ANALYSIS OF SUSPENDED SOLIDS IN THE WATER USING A LASER DIFFRACTION METER,**
Centre de Recherche de l'Omnium d'Assainissement, Colombes (France).

For primary bibliographic entry see Field 5D.
W82-00463

**CLINICAL TESTS IN AQUATIC TOXICOLOGY: STATE OF THE ART,**
Columbia National Fisheries Research Lab., MO.
P. M. Mehrle, and F. L. Mayer.
Environmental Health Perspectives, Vol 34, p 139-143, February 1980. 20 Ref.

Descriptors: *Aquatic life, *Toxicity, Chemical compounds, Water pollution, Assessment, Poisons, Indicators, Bioindicators, Public health, Environmental effects, Effects of pollutants, *Fish.

Problems involved in developing diagnostic tests for fish are described, along with the philosophy behind their development and their application in aquatic toxicology. Development of diagnostic tests for fish requires consideration of an understanding of the functions and composition of organs primarily affected by toxic chemmicals; knowledge of analytical procedures to measure appropriate biochemical constituents, cellular morphology, and physiological responses; and the ability to interpret the significance of chemical-induced biophysiological changes and relate them to fish health and survival. The current state of the art of clinical analyses or diagnostic tests in aquatic toxicology is not well advanced. Useful diagnostic or biological indicators have not been developed. One major problem has been the lack of a comprehensive, integrated approach in toxicological studies on fish. To adequately assess the influence of contaminants on the aquatic environment and to overcome the avoidance of biochemical and physiological testing, investigators should develop techniques that can serve as biological indicators in the field as well as predictors in the laboratory to estimate the health of a particular aquatic resource. One of the major principles to be followed is the need to plan and execute the biochemical and physiological research within the framework of conditions existing in the 'real world'. (Baker-FRC)
W82-00464

**TADPOLES AS INDICATORS OF HARMFUL LEVELS OF POLLUTION IN THE FIELD,**
Nature Conservancy, Abbotts Ripton (England). Monks Wood Experimental Station.
A. S. Cooke.
Environmental Pollution, (Series A), Vol 25, No 2, p 123-133, June, 1981. 4 Fig, 31 Ref.

Descriptors: *Frogs, *Bioindicators, *Water pollution effects, Indicators, *Tadpoles, Water pollution, Oxamyl, Sublethal effects, Runoff, Spraying.

A technique was developed using caged tadpoles to assess potential freshwater pollutants from runoff of spray drift. Mortality, growth, rate of metramorphosis, and occurrence of deformities are monitored. A field test was performed, and the incidence of tadpole deformities was found to be unusually high in cages near a potato field which was treated with oxamyl. Oxamyl is a carbamate nematicide and insecticide. Tadpoles next to the potato fields suffered significantly higher incidences of vertical curvature deformities. Treatment of tadpoles in the laboratory showed similar results. Thus, exposure to environmental stress can cause increases in deformities seen in tadpoles. While this does not prove that the chemical being tested is dangerous, it indicates that the chemical warrants further study. (Small-FRC)
W82-00478

**CHARACTERIZATION OF SOLUBLE AND COLLOIDAL-PHASE METAL COMPLEXES IN RIVER WATER BY ULTRAFILTRATION. A MASS-BALANCE APPROACH,**
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
M. R. Hoffmann, E. C. Yost, S. J. Eisenreich, and W. J. Maier.
Environmental Science and Technology, Vol 15, No 6, p 655-661, June, 1981. 3 Fig, 3 Tab, 64 Ref.

Descriptors: *Ultrafiltration, *Trace metals, *Rivers, Measurement techniques, Membrane filters, Organic matter, Copper, Calcium, Magnesium, Colloids, Solutes, Cadmium, Lead, Dissolved solids, Molecular structure, Mathematical equations.

Previous water quality studies have indicated that it is necessary to know both the total metal concentrations in soluble and particulate phases and the species of the metal in order to reliably predict biological availability and ultimate fate in aquatic systems. This paper reports the development of a new approach to size fractionation by ultrafiltration which uses a cascade procedure and a system of mass-balance equations, eliminating the need for repeated washings or excessive concentration. This procedure is followed by atomic absorption spectrophotometry and anodic stripping voltammetry measurements of metal concentrations. The process has been used to determine the distribution and degree of association of major trace metals with discrete size fractions of dissolved organic matter which initially passes through a 0.4 micrometer membrane filter. Application of the process to samples from the Mississippi and Minnesota Rivers demonstrated that the highest concentrations of trace metals are often found in intermediate molecular weight ranges (1,000 to 10,000) with no detectable free or labile metal as determined by anodic stripping voltammetry. Calcium and magnesium, which were generally found in the lower molecular size ranges, did not appear to have a significant impact on the apparent extent of interaction of other metals with dissolved organic matter. The moderate residual complexation capacity for copper (1.0 plus or minus 0.1 microM) and the relatively high pseudostability constant (log K = 10.4) for copper complexation found in samples from the Mississippi River suggest that complexation of trace metals such as copper, cadmium, and lead may be dominated by aquatic organics and that formation of carbonato complexes is of secondary importance. (Carroll-FRC)
W82-00480

**COMPARISON OF AUTOMATED SEGMENTED-FLOW AND DISCRETE ANALYZERS FOR THE DETERMINATION OF NUTRIENTS IN WATER,**
National Water Quality Lab., Arvada, CO.
V. C. Marti, and D. R. Hale.
Environmental Science and Technology, Vol 15, No 6, p 711-713, June, 1981. 4 Fig, 2 Tab, 5 Ref.

Descriptors: *Nutrients, *Water analysis, *Measurement techniques, Chemical analysis, *Colorimetry, Measuring instruments, Comparison studies, Pollutant identification.

Many automated colorimetric analysis methods using segmented flow systems have come to be referenced as standard techniques. However, colorimetric analyses can usually be made with greater speed on automated 'discrete' systems for most of the chemical species determined by the referenced methods. The analytical results obtained using the Technicon AAII, a segmented flow system which automatically moves a sample through a closed system of tubing and mixing coils using air-segmented streams of reagents and sample, and the Coulter IKL, a discrete technique which automatically moves a sample and reagents in an open reaction tube through a water bath, were compared. Thirty-nine randomly selected water samples from six states were analyzed for ammonia-N (NH3-N), nitrate plus nitrite-N (NO3 plus NO2-N), nitrite-N (NO2-N), and phosphate-P (PO4-P). Plots of the discrete versus the segmented flow results demonstrated linear correlation coefficients of 0.9980 for NH3-N, 0.9997 for NO3 plus NO2-N, 0.9998 for NO2-N, and 0.9950 for PO4-P. The significances of the slope and of the y intercept of each plot are discussed in terms of possible biases which may exist between the two systems. The discrete analyzer was able to analyze 60 samples per hour for the four analytes, while the segmented-flow analyzer's rate was 40 samples per hour. The comparative accuracy and precision of the two instruments were indicated by the results of the standard reference analyses, by the results of six natural samples used for the precision study, and by the regression statistics pertaining to the 39 unknown water samples. (Carroll-FRC)
W82-00483

**MEMBRANE FILTER METHOD FOR ENUMERATING ESCHERICHIA COLI,**
Health Effects Research Lab., West Kingston, RI.
A. P. Dufour, E. R. Strickland, and V. J. Cabelli.
Applied and Environmental Microbiology, Vol 41, No 5, p 1152-1158, May, 1981. 4 Fig, 3 Tab, 23 Ref.

Descriptors: *Membrane filters, *Escherichia coli, *Bacterial analysis, Coliforms, Bacteria, Enteric bacteria, Sewage bacteria.

Although many tests have been devised to enumerate Escherichia coli based on the ability of this organism to produce indole from tryptophane at an elevated temperature, there are two inherent problems with the method. The determination of indole production in conjunction with a most probable number procedure generally requires transfer of bacteria from lactose broth to another medium and an additional 24-hour incubation period. In addition, further examination of the colonies under consideration is prohibited since the reagents used for the indole test are bactericidal. The development of a simple, accurate, nonlethal membrane filter technique for rapid enumeration of E. coli is reported. E. coli can be quantitied within 24 hours using this method without requiring subculture and identification of isolates. The method incorporates a primary selective-differential medium for gram-negative, lactose-fermenting bacteria; resuscitation of weakened organisms by incubation for 2 hours at 35 degrees C prior to incubation at 44.5 degrees C for 18 to 22 hours; and an in situ urease test to differentiate E. coli from other thermotolerant, lactose-positive organisms. Use of the method on marine, estuarine, and freshwater samples resulted in recovery rates for E. coli exceeding 90%. Of the presumptively positive colonies, 91% were verified as E. coli. Nonspecificity occurred most often with fresh water samples, but the frequency of false-positive colonies (15%) was not high enough to preclude its use in those environments. Over 99% of the verified E. coli colonies reacted typically. (Carroll-FRC)
W82-00487

**INCIDENCE OF VIBRIO ALGINOLYTICUS AND BACTERIA OF SANITARY SIGNIFICANCE IN THE BERING SEA,**
Food and Drug Administration, Seattle, WA.
C. A. Kaysner.
Applied and Environmental Microbiology, Vol 41, No 5, p 1279-1282, May, 1981. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Sewage bacteria, *Bering Sea, *Vibrio, Bacteria, Marine bacteria, Marine environments, Sediments, Seawater, Clams, Mollusks, Environmental tracers, Commercial shellfishing, Public health.

Vibrio parahaemolyticus is a bacterium commonly isolated from temperate marine environments throughout the world. Vibrio alginolyticus, the non-enteropathogenic species, is commonly found in marine samples at temperatures above 5 degrees C. The feasibility of commercial clam harvest in the Bering Sea was studied by a joint industry-government assessment team in 1977. Clams, seawater samples, and sediment samples were analyzed in the bacteriological laboratory on board the National Oceanic and Atmospheric Administration's research vessel used in the study. The bacteriological counts of the clams, sediment samples, and seawater samples were all low. V. alginolyticus was isolated from 2 of 153 total samples at most probable numbers of 5.1 and 16 per 100 milliliters. V. parahaemolyticus was not detected in any of the samples, probably due to the low water temperatures. It is possible that V. parahaemolyticus may be found in the coastal regions of the Bering Sea, where temperatures are higher during the summer months. (Carroll-FRC)
W82-00490

**MICROPLATE TECHNIQUE FOR DETERMINING ACCUMULATION OF METALS BY ALGAE,**
Syracuse Univ., NY. Dept. of Civil Engineering.
J. M. Hassett, J. C. Jennett, and J. E. Smith.

Applied and Environmental Microbiology, Vol 41, No 5, p 1097-1106, May, 1981. 4 Fig, 6 Tab, 31 Ref.

Descriptors: *Heavy metals, *Algae, *Measurement techniques, Mercury, Lead, Cadmium, Zinc, Salinity, Bioaccumulation, Accumulation, Chelating agents, Pollutant identification.

Although the ability of many species of algae to accumulate metals from their aqueous environments may have a significant impact on bioaccumulation of metals in the food chain and implications for wastewater treatment, there has been no systematic survey of algae for this ability. A microplate analytic technique has been developed which can be used to determine the uptake of heavy metals by pure cultures of algae. The equipment includes plastic, U-bottomed microtiter plates, disposable harvesting frames, a transfer fork, and a press. The technique was used to survey the effects of several combinations of environmental factors on the removal of mercury, lead, cadmium, and zinc by green and blue-green algae and to describe the kinetics of metal uptake. Variables investigated included algal species and strain, culture age (11 and 44 days), pH, effects of different buffer solutions, and time of exposure. Concentration factors, which are the ratio of the metal concentration in the algae to that in the surrounding water, were determined for the various metal-alga combinations. The concentration factors obtained were in reasonably good agreement with those reported in the literature. Mercury was removed from solution by all species of algae studied, while no alga studied removed zinc, possibly due to keeping the cells in the dark during the labeling period. Green algae were found to be better at accumulating cadmium than were blue-green algae. Chlamydomonas sp. proved superior to all other species of algae studied in ability to remove lead from solution. The techniques was found to be rapid, statistically reliable, and economical of materials, cells, and laboratory space. There is no reason to believe that the technique could not be used successfully in similar studies with bacteria, fungi, protozoa, and other microbes or with other gamma-emitting and possibly beta-emitting nuclides. (Carroll-FRC)
W82-00492

**IMPACT OF VERIFICATION MEDIA AND RESUSCITATION ON ACCURACY OF THE MEMBRANE FILTER TOTAL COLIFORM ENUMERATION TECHNIQUE,**
Oregon State Univ., Corvallis. Dept. of Microbiology.
T. M. Evans, R. J. Seidler, and M. W. LeChevallier.
Applied and Environmental Microbiology, Vol 41, No 5, p 1144-1151, May, 1981. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Bacterial analysis, *Coliforms, *Membrane filters, Bacteria, Water quality, Filter media.

The membrane filter method is usually the method of choice for the enumeration of total coliforms in water supply samples. However, serious limitations of this technique have been discovered recently, including failure to detect coliforms in turbid drinking water samples and production of green sheen in lactose-containing media, which interferes with the accuracy of the count. A verification procedure has been adopted by the Environmental Protection Agency for use on green-sheen colonies. The influence of verification media and resuscitation on the number of membrane filter typical colonies which produce gas during verification was investigated. The use of lauryl tryptose broth (LTB), lactose broth (LB), and m-LAC broth as primary media was compared, and the need for and use of brilliant-green-lactose-bile (BGLB) broth as secondary media was investigated. Verification in m-LAC broth yielded the greatest number of aerogenic isolates for both untreated surface water and drinking water samples. Verification in BGLB broth increased the number of false-negative reactions. The addition of a resuscitation step in membrane filter analysis did not result in verification of greater numbers of coliforms per sample. The use of m-LAC broth for verification of typical and atypical colonies resulted in a 10-fold increase in coliform numbers from untreated surface water. Verification of both colony types in drinking water resulted in an increase from less than 1 coliform/100 milliliters to greater than 1/100 milliliters. It is concluded that a single-step verification in m-LAC broth would provide a more rapid and sensitive coliform verification procedure than the standard technique involving both subculturing in LTB and subsequent subculturing in BGLB broth. (Carroll-FRC)
W82-00494

**COMPARISON OF TWO DIRECT-COUNT METHODS FOR DETERMINING METABOLIZING BACTERIA IN FRESHWATER,**
Wisconsin-Milwaukee Univ. Center for Great Lakes Studies.
J. S. Maki, and C. C. Remsen.
Applied and Environmental Microbiology, Vol 41, No 5, p 1132-1138, May, 1981. 1 Fig, 2 Tab, 29 Ref.

Descriptors: *Bacterial analysis, *Metabolism, *Aquatic bacteria, Bacteria, Freshwater, Analytical techniques, Comparison studies.

Since not all bacteria present in aquatic systems are metabolically active, determination of a normalized percentage of metabolically active cells to total counts would be useful to microbial ecologists interested in determining the influence of microorganisms on a given aquatic environment. Two methods for determining the numbers of metabolizing bacteria were compared using planktonic bacteria collected from several freshwater environments and cultured bacteria. The first method involves the reduction of 2-(rho-iodophenyl)-3-(rho-nitrophenyl)-5-phenyl tetrazolium chloride (INT) to INT-formazan crystals by active bacterial electron transport systems. The second method uses a preincubation of the sample with a combination of yeast extract and nalidixic acid (YE + NA), which results in specific inhibition of deoxyribonucleic acid synthesis and subsequent cell elongation. No statistically significant difference was found between methods in determining metabolizing bacteria, although significant differences ($P < 0.05$) were found when comparing numbers of total bacteria. The proportion of metabolizing bacteria with respect to the total count found in this study agreed with values previously reported. Combination of the two techniques resulted in slightly higher counts of metabolizing bacteria than those found in the tests performed individually in some cases and in significantly lower counts in several instances. Both methods are easily performed and provide data on total and metabolizing bacteria within a matter of hours. (Carroll-FRC)
W82-00495

## 5B. Sources Of Pollution

**MOUNT ST. HELENS VOLCANIC-ASH FALL IN THE BULL RUN WATERSHED, OREGON, MARCH-JUNE 1980,**
Geological Survey, Portland, OR. Water Resources Div.
M. V. Shulters, and D. G. Clifton.
Available from the Br. of Dist., USGS, 604 S. Pickett St. Alexandria, VA 22304. Geological Survey Circular 850-A, 1980. 15 p, 6 Fig, 3 Tab, 8 Ref.

Descriptors: *Volcanoes, *Environmental effects, *Water quality, Large watersheds, Water supply, Fallout, Particle size, Water pollution sources, Path of pollutants, Precipitation, Weather patterns, Oregon, *Bull Run watershed, Washington, *Mount St. Helens, *Volcanic ash.

During several periods of volcanic-ash eruption at Mount St. Helens, Wash., (March 30, May 25-26, May 30-June 2, and June 12-13, 1980) strong winds from the north occurred at high altitudes. As a result, the volcanic ash fell some 50 miles to the south in the Bull Run watershed, the principal water-supply source for the metropolitan area of Portland, Oreg. Water samples collected from three stream sites within the watershed were compared with samples collected during the same season in previous years. No detectable changes were noted in chemical characteristics. Precipitation samples collected immediately after the June 12-13 ash fall ranged in specific conductance from 20 to 41 micromhos per centimeter at 25C and in pH from 4.0 to 4.3 pH units. Stream samples collected during the May-June period ranged in specific conductance from 18 to 28 micromhos per centimeter at 25C and in pH from 6.7 to 7.5 pH units. Volcanic-ash samples were collected and analyzed for particle size, chemical composition, and weight. Significant differences in particle size of ash were found in samples from two separate eruptions. (USGS)
W82-00002

**MUDFLOWS RESULTING FROM THE MAY 18, 1980, ERUPTION OF MOUNT ST. HELENS, WASHINGTON,**
Geological Survey, Tacoma, WA. Water Resources Div.
J. Cummans.
Available from the Br. of Dist., USGS, 604 S. Pickett St. Alexandria, VA 22304. Geological Survey Circular 850-B, 1981. 16 p, 11 Fig, 2 Tab, 2 Ref.

Descriptors: *Mudflows, *Volcanoes, *Streams, *Drainage areas, Avalanches, Detritus, Sediments, Floods, Runoff, *Washington, *Mount St. Helens, North Fork Toutle River, Toutle River, Cowlitz River, Debris avalanche, Volcanic ash.

On May 18, 1980, Mount St. Helens, in southwestern Washington, erupted violently, setting off a chain of devastating hydrologic event. During the eruption, a massive debris avalanche moving down the north side of Mount St. Helens was deposited in the North Fork Toutle River valley. Approximately 3 billion cubic yards of material, including rock, ash, pumice, snow, and ice was deposited directly north of the mountain in the upper 17 miles of the valley. Following the eruption, mudflows quickly developed in the South Fork Toutle River, and in the Lewis River tributaries of Smith Creek, Muddy River, and Pine Creek. Several hours later a massive mudflow originated from the debris avalanche deposit in the North Fork Toutle River valley. This North Fork mudflow caused widespread destruction as it moved downstream through the lower Toutle and Cowlitz Rivers. This report describes the location and chronology of the mudflows which followed the May 18 eruption. Average velocities are presented for the mudflows in the South and North Fork Toutle Rivers, and photographs illustrate the character of the debris and mud deposits. (USGS)
W82-00003

**CHANNEL CONDITIONS IN THE LOWER TOUTLE AND COWLITZ RIVERS RESULTING FROM THE MUDFLOWS OF MAY 18, 1980,**
Geological Survey, Tacoma, WA. Water Resources Div.
R. E. Lombard, M. B. Miles, L. M. Nelson, D. L. Kresch, and P. J. Carpenter.
Available from the Br. of Distr., USGS, 604 S. Pickett St. Alexandria, VA 22304. Geological Survey Circular 850-C, 1981. 16 p, 13 Fig, 1 Tab, 9 Ref.

Descriptors: *Volcanoes, *Floodwater, *Flood control, *Mudflows, Sediments, Dredging, Flood protection, Flood plains, Runoff, Flood forecasting, Maximum probable floods, *Washington, *Mount St. Helens, Toutle River, Cowlitz River, Castle Rock.

The volcanic eruption of Mount St. Helens on May 18, 1980, triggered mudflows on the South and North Forks of the Toutle River that deposited up to 15 feet of sediment in the channels of the lower Toutle and Cowlitz Rivers. The thickness of the sediment deposited on the flood plain ranged from almost none just upstream from Kelso to about 10 feet near Castle Rock and the mouth of the Toutle River. Existing levees in Castle Rock, Kelso, and Longview contained the mudflows and prevented flooding of those communities. The

mudflow reduced the within-channel flow capacity, except at Kelso and Longview where the effect was minor. The potential exists for unusually high flood levels, up to 10-feet higher than normal, from autumn and winter precipitation. Planned flood-alleviation measures include dredging, additional levees, and sediment-retention structures. A flood-warning system has been established, and the current potential for flooding is being monitored through continued surveillance of the river system. (USGS)
W82-00004

**POLYCHLORINATED BIPHENYL TRANSPORT IN THE HUDSON RIVER, NEW YORK,**
Geological Survey, Albany, NY. Water Resources Div.
J. T. Turk, and D. E. Troutman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-249757, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-9, 1981. 11 p, 5 Fig, 2 Tab, 3 Ref.

Descriptors: *Water quality, *Polychlorinated biphenols, *Suspended solids, *Pollutants, River flow, Wastewater disposal, Sediments, Suspended sediments, *New York, *Hudson River, Resuspension, Point discharge, Path of pollutants.

Polychlorinated biphenyls (PCB's) have been entering the Hudson River estuary since 1951. Concentration and loading of PCB's in the river below Waterford, N.Y., are controlled at present by resuspension of sediments containing these substances; therefore, until the amount of PCB's in the sediments is significantly lowered, reduction of point-source PCB discharge from the present rate of 0.4 kilograms per day will produce no more than a 10% reduction in loading to the river. Potential concentrations of PCB's in solution and suspension in the river can be predicted by a simple model for mixing and dilution. From a known range of PCB influent rates, total PCB loading to the Hudson River from above Waterford is shown to be between 2,000 and 12,000 kilograms per year. (USGS)
W82-00008

**RELATIONSHIP OF WATER QUALITY OF HUDSON RIVER, NEW YORK, DURING PEAK DISCHARGES TO GEOLOGIC CHARACTERISTICS OF CONTRIBUTING SUBBASINS,**
Geological Survey, Albany, NY. Water Resources Div.
J. T. Turk, and D. E. Troutman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-249740, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-108, 1981. 15 p, 1 Fig, 6 Tab, 6 Ref.

Descriptors: *Water quality, *Streams, *Polychlorinated biphenols, *Sediment transport, Pollutants, Geohydrology, Sediments, Phosphorus, Heavy metals, Suspended sediments, Chemical analysis, Least squares method, *New York, *Hudson River, Resuspension.

Water samples from two Hudson River floods in 1977--one originating mainly in shale subbasins that produce high sediment loads, the other in soil-poor, crystalline rock terrane that yields little sediment--were analyzed to evaluate the relationship of iron, manganese, lead, phosphorus, and polychlorinated biphenyls (PCB's) to suspended-sediment concentration. During the flood of high sediment discharge, ratios for all substances studied except PCB's reflected their concentration within the basin regolith. During the flood of smaller magnitude, from the low-sediment crystalline terrane, however, only the ratio for iron correlated with predicted concentrations in the basin, which suggests that the chemical constituents studied were contributed principally from other sources, possibly anthropogenic sources. High lead concentrations in the low-sediment flood were derived from an unidentified, basinwide source whose contribution was relatively insignificant during the flood from the shale area. (USGS)
W82-00009

**RECONNAISSANCE OF THE EFFECT OF LANDFILL LEACHATE ON THE WATER QUALITY OF MARSHALL BROOK, SOUTHWEST HARBOR, HANCOCK COUNTY, MAINE,**
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5C.
W82-00013

**EVALUATION OF THE MALAGA BEND SALINITY ALLEVIATION PROJECT, EDDY COUNTY, NEW MEXICO,**
Geological Survey, Albuquerque, NM. Water Resources Div.
J. L. Kunkler.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1111, September 1980. 31 p, 5 Fig, 4 Tab, 20 Ref.

Descriptors: *Brines, *Rivers, *Water quality, *Salinity, Reservoirs, Leakage, Water analysis, Aquifers, Evaluation, *New Mexico, Eddy County, Pecos River, Malaga Bend.

In an effort to reduce the flow of brine springs in the Malaga Bend reach of the Pecos River in southeastern New Mexico, brine was pumped from an aquifer underlying the Malaga Bend reach to a local depression known as Anderson Lake. The attempt to improve the quality of river water with this experiment was not successful because brine leakage from Anderson Lake to the nearby Pecos River through permeable subsurface rocks was greater than the previous natural spring inflow. Brine leakage from Anderson Lake from July 22, 1963, through September 30, 1968, was estimated by evaporation-pan, salt accumulation, and dissolved-constituent methods. The leakage values given by these three methods are in good agreement with each other and indicate that between the dates given, leakage from the lake was about 2,300 acre-feet, compared with a brine inflow to the lake of about 3,690 acre-feet. Other data indicate that pumping from the brine aquifer greatly reduced the natural inflow from brine springs to the Malaga Bend reach. The rate of brine leakage from Anderson Lake is probably greater than might be expected from other brine lakes in the area because the cavities in the bottom of the lake apparently are in hydrologic connection with the Pecos River. This connection is shown by a relation between the salinity of the Pecos River and the reservoir stage of Anderson Lake. (USGS)
W82-00018

**CARBON ISOTOPES AS INDICATORS OF THE SOURCE AND FATE OF CARBON IN RIVERS AND ESTUARIES,**
Geological Survey, Reston, VA.
E. C. Spiker.
Available from the National Technical Information Service, Springfield, VA as CONF-8009140, Price codes: A18 in paper copy, A01 in microfiche. In: Flux of Organic Carbon by Rivers to the Oceans, Report of a Workshop, Woods Hole, MA, Sept 21-25, 1980, Dept. of Energy Report CONF-8009140, April 1981. p 75-108, 6 Fig, 2 Tab, 44 Ref.

Descriptors: *Carbon radioisotopes, *Carbon cycle, *Indicators, *Tracers, Vegetation, Estuaries, Rivers, Organic carbon.

The double isotopic labeling of carbon is particularly useful for the analysis of sources and sinks of carbon. The onset of nuclear weapons testing in 1954 resulted in a large input of bomb-produced excess carbon-14. The spread of bomb carbon-14 through the terrestrial carbon pool offers considerable potential in resolving the question of whether an increase in carbon transport by rivers might be due to increased photosynthesis or to increased soil erosion, by determining the time of fixation by photosynthesis. Delta carbon-13 is a relatively simple and reliable source indicator that can discriminate between terrestrial and marine organic carbon. A comparison of delta carbon-13 distributions in the San Francisco Bay and the Potomac River estuary demonstrates the varying importance of estuarine primary productivity in different systems. The analysis of both carbon-14 and carbon-13 provides unique information about the derivation and processing of carbon in rivers. The usefulness of these techniques is of course greatly enhanced when applied in conjunction with other tracers, such as nitrogen-15, C/H/N ratios, and various organic compounds. Delta nitrogen-15 may be very useful if it can distinguish between fresh-water aquatic plants and land plants. The new solid-state carbon-13 NMR techniques should provide a powerful tool that can discriminate between algal and vascular plant carbon. (Moore-SRC)
W82-00033

**DEPOSITION OF RIVERBORNE ORGANIC CARBON IN FLOODPLAIN WETLANDS AND DELTAS,**
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 2J.
W82-00034

**CHEMICAL INDICATORS OF ORGANIC RIVER SOURCES IN RIVERS AND ESTUARIES,**
Washington Univ., Seattle. Dept. of Oceanography.
J. I. Hedges.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-8009140, Price codes: A18 in paper copy, A01 in microfiche. In: Flux of Organic Carbon by Rivers to the Oceans, Report of a Workshop, Woods Hole, MA, Sept 21-25, 1980, Dept. of Energy Report CONF-8009140, April 1981. p 109-141, 7 Fig, 1 Tab, 61 Ref.

Descriptors: *Indicators, *Tracers, *Organic matter, *Biochemistry, *Water pollution sources, Carbohydrates, Lipids, Proteins, Organic compounds, Estuaries, Terrestrial plants, Lignins.

Almost all molecular tracers used to distinguish the geographic or biological sources of organic matter in natural environments are derived from photosynthetic plants. Molecular organic indicators can be classified in terms of the four major categories of plant natural products: carbohydrates, proteins, phenolics (primarily lignins), and lipids. Higher land plants, which are composed primarily of cellulose and lignin, contain relatively little organic nitrogen. C/N ratios have been used to establish the presence of land derived organic matter in sediments and suspended particulate matter, but the wide range of C/N values in higher plants and the effects of diagenesis are a disadvantage. Of the carbohydrates, the natural sugars and uronic acids have some potential for use as terrestrial tracers. Lignins are the only major biochemicals to have an unambiguous terrestrial origin. Lignin-derived phenols can be used to obtain information concerning the taxonomic and tissue sources of lignin mixtures, and to estimate quantitatively the amount of vascular plant remains. This lipids include a variety of molecular types that can be applied as terrestrial tracers. Leaf wax hydrocarbons have been used extensively to trace higher-plant lipids in rivers, estuaries, and the open ocean. Certain tricyclic diterpenoid hydrocarbons are also used as terrestrial source indicators. Linear, unsaturated fatty acids are a major lipid component of higher plants, and can be used as indicators of land-derived material. Diterpenoid resin acids are also useful terrestrial source indicators. Sterols are useful geochemical tracers because of their relatively high chemical stability and taxonomically related structural diversity. (Moore-SRC)
W82-00035

**WATER QUALITY ISSUES AND ENERGY ASSESSMENTS,**
Argonne National Lab., Argonne, IL.
For primary bibliographic entry see Field 6B.
W82-00036

**MODELING PHOSPHORUS LOADING AND LAKE RESPONSE UNDER UNCERTAINTY: A**

MANUAL AND COMPILATION OF EXPORT COEFFICIENTS.
Environmental Protection Agency, Washington, DC.
Report EPA-440/5-80-011, June 1980. 223 p, 22 Fig, 31 Tab, 195 Ref, Append.

Descriptors: *Mathematical models, *Phosphorus, *Cycling nutrients, *Eutrophication, Pollution load, Land use, Trophic level, Air pollution, Error analysis, Precision, Prediction, Lakes, *Limnology, Environmental effects.

A procedure is proposed that may be used to quantify the relationship between land use and lake trophic quality. The methodology is based on an input-output phosphorus lake model. When it is employed to predict the impact of projected land use changes, it is necessary to use phosphorus export coefficients extrapolated from other points in time and/or space. These coefficients represent the mass loading of phosphorus to a surface water body per year per unit of source. Nitrogen and phosphorus export coefficients from different land uses including forest, crops, pasture and grazing land, urban, septic tanks and absorption fields, and sewage treatment plants are given. The impact of atmospheric inputs is noted. The criteria for selecting the appropriate coefficients are: accuracy, precision, representativeness, temporal extent of sampling, nutrient flux estimation, and concentration and flow data. The model includes an error estimation procedure, and is applicable to a fairly wide range of lake types. The limitations of the methodology involve uncertainties in the input information and their impact on prediction precision. (Brambley-SRC)
W82-00039

ABSORPTION OF RADIUM AND THORIUM FROM NEW MEXICO URANIUM MILL TAILING SOLUTIONS,
Bureau of Mines, Salt Lake City, UT. Salt Lake City Research Center.
For primary bibliographic entry see Field 5D.
W82-00040

COMPUTER MODELING OF FLUID FLOW DURING PRODUCTION AND ENVIRONMENTAL RESTORATION PHASES OF IN SITU URANIUM LEACHING,
Bureau of Mines, Twin Cities, MN. Twin Cities Research Center.
For primary bibliographic entry see Field 6A.
W82-00043

QUALITY OF WATER IN TIBBEE CREEK AND TRIBUTARIES NEAR WEST POINT, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
S. J. Kalkhoff.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $6.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-406, 1981. 42 p, 7 Fig, 3 Tab, 12 Ref.

Descriptors: *Water quality, *Surface water, *Streamflow, *Hydrologic data, Sampling, Water analysis, Bacteria, *Mississippi, Tibbee Creek, Town Creek, Catalpa Creek, Path of pollutants.

An intensive water-quality study was conducted on Tibbee Creek and two of its tributaries, Town Creek and Catalpa Creek, on June 19-22, 1979. The data were collected during a period of low discharge and high air temperatures. The water in Tibbee Creek and Catalpa Creek was of much better quality than water in Town Creek. Large quantities of nitrogen, phosphorus, and dissolved solids and high densities of fecal coliform were present in Town Creek. The five-day biochemical oxygen demand values averaged 14 mg/L, and the mean total nitrogen concentration was 56 mg/L. The mean concentrations of ammonia, nitrate plus nitrite nitrogen, and organic nitrogen were 1.8 mg/L, 50 mg/L, and 3.7 mg/L, respectively. A total phosphorus load of more than 400 pounds per day, more than 91% of the total phosphorus load leaving the study area, was carried by Town Creek into Tibbee Creek. Total phosphorus concentrations averaged 14 mg/L in Town Creek and 0.11 and 0.12 mg/L in Tibbee and Catalpa Creeks respectively. Bacterial densities were higher at site 2 in Town Creek than at sites 1 and 3 in Tibbee and Catalpa Creeks respectively. The median fecal coliform bacterial density was 25,000 col/100 mL (colonies per 100 milliliters) in Town Creek and less than 200 col/100 mL in Tibbee and Catalpa Creeks. Median fecal streptococcal densities were 1,000 col/100 mL in Town Creek, 210 col/100 mL in Tibbee Creek, and 800 col/100 mL in Catalpa Creek. Fecal coliform to fecal streptococcal ratios were greater than 4.0 in Town Creek, indicating wastes of human origin were probably present during the study. Ratios were less than 0.7 in Tibbee and Catalpa Creeks, indicating human wastes were probably absent during the study. (USGS)
W82-00084

PLANNING STUDY TO MODEL AND MONITOR COAL PILE RUN-OFF,
TRC Environmental Consultants, Inc., Wethersfield, CT.
For primary bibliographic entry see Field 6A.
W82-00091

EFFECT OF AGRICULTURAL LAND DEVELOPMENT ON DRAINAGE WATERS IN THE NORTH CAROLINA TIDEWATER REGION,
North Carolina State Univ. at Raleigh.
R. W. Skaggs, J. W. Gilliam, T. J. Sheets, and J. S. Barnes.
Environmental Protection Agency Project Summary EPA-600/S3-80-087, July 1981. 3 p.

Descriptors: *Agricultural runoff, *Drainage, Water quality, *Pesticide residues, *Agricultural hydrology, *Land development, Land use, Nitrogen, Phosphorus, Organic soils, Herbicides, Coliforms, Evapotranspiration, Pesticide drift, Subsidence, *North Carolina, *Tide lands.

In a three-year study, the effect of agricultural drainage and development on hydrology and the effect of runoff water quality on high organic soils were examined in the North Carolina Tidewater Region. A small but significant increase was found in organic nitrogen in drainage water as a result of agricultural development. True organic soils lost considerably more phosphorus to drainage waters. Development caused a decrease in evapotranspiration with a consequent small increase in annual outflow even during years when droughts occurred. Dissolved oxygen, biochemical oxygen demand, temperature, pH, and other water quality parameters exhibited relatively small changes as a result of development. A significant increase in the loss of fecal and total coliform bacteria from pasture land was observed, which represents a potential water quality problem. Studies of the herbicide alachlor showed that it disappeared rapidly from soil after application but also showed that low, nonphytotoxic concentrations persisted from one season to the next. High concentrations in drainage waters appeared to be caused by direct spraying or by spray drift. Soil subsidence was greatest immediately after development.
W82-00094

WATER POLLUTION POTENTIAL OF COAL-SLURRY PIPELINES,
Montana State Univ., Bozeman, Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 6A.
W82-00096

USE OF THE ELECTROLYTIC RESPIROMETER TO MEASURE BIODEGRADATION IN NATURAL WATERS,
Procter and Gamble Co., Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W82-00126

AN EMPIRICAL EQUATION FOR PREDICTING SOLUBLE PHOSPHORUS LOADS FROM AGRICULTURAL WATERSHEDS,
Wisconsin Univ.-Madison. Water Resources Center.
B. A. Miller, and T. C. Daniel.
Transactions of the ASAE, Vol 24, No 2, p 375-381, 390, March-April, 1981. 8 Tab, 33 Ref.

Descriptors: *Phosphorus compounds, Land use, *Nutrients, Runoff, Regression analysis, Rainfall-runoff relationships, Fate of pollutants, Small watersheds, *Agricultural watersheds, Pollutant load, *Agricultural runoff.

An empirical equation was developed to predict soluble reactive phosphorus (SRP) loads from agricultural watersheds. This equation was derived from regression analysis of data on nutrient loading studies conducted on locations with Midwest-type climates. Factors affecting SRP loadings were precipitation, area, slope, soil type, land use, and farm practices. The equation was used to predict SRP loads from agricultural watersheds in Washington County, Wisconsin, based on 1976-1978 data. Predicted and observed loads were a function of land use, the percentage of land in hay having the most influence. Effects of fertilizer usage, depth of surface runoff, and tillage practices were not statistically significant. The equation does not account for weather and snowmelt variations nor for sediment-soluble P interactions. It is more accurate on small watersheds. (Cassar-FRC)
W82-00134

SEDIMENT AND NUTRIENT MOVEMENT FROM THE BLACK CREEK WATERSHED,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
E. J. Monke, D. W. Nelson, D. B. Beasley, and A. B. Bottcher.
Transactions of the ASAE, Vol 24, No 2, p 391-395, 400, March-April, 1981. 1 Fig, 14 Tab, 8 Ref.

Descriptors: *Sediment transport, *Nutrients, *Pollution load, Path of pollutants, Erosion, Phosphorus compounds, Nitrogen compounds, Snowmelt, Runoff, Rainfall, Nonpoint pollution sources, Agricultural runoff, Water quality, Black Creek, *Indiana, Maumee River, Lake Erie.

Discharge from the Black Creek Watershed, Indiana, was monitored to study the effects of nonpoint source pollution from agricultural runoff on water quality of the Maumee River, which flows into Lake Erie. Data from 1975, a high rainfall year (108.0 cm), and 1976, a low rainfall year (67.0 cm), were used. Two subbasins with contrasting soils and land uses were compared. The Dreisbach drainage area (gently rolling, glacial till) is more residential and has more grain and pasture. The Smith-Fry drainage area (lake plain and beach, nearly level) has few homes and 63% row crops. Runoffs were 26.0-29.1 cm in 1975 and 10.1-12.4 cm in 1976. Sediment yields (in kg per ha) were: Smith-Fry, 2130 in 1975 and 640 in 1976; Dreisbach, 3740 in 1975 and 380 in 1976; and Black Creek, 2370 in 1975 and 530 in 1976. Total N loadings (in kg per ha) were: Smith-Fry, 53.2 in 1975 and 10.3 in 1976; Dreisbach, 44.1 in 1975 and 6.6 in 1976; and Black Creek, 48.7 in 1975 and 8.6 in 1976. Total P loadings (in kg per ha) were: Smith-Fry, 5.4 in 1975 and 1.1 in 1976; Dreisbach, 5.0 in 1975 and 1.0 in 1976; and Black Creek, 5.2 in 1975 and 1.1 in 1976. More soluble inorganic P came from the residential Dreisbach area, and more nitrates from the Smith-Fry agricultural area. From 77 to 96% of P and about 50% of the N was bound to sediment transported. Large storms produced the greatest amount of sediment and nutrient transport. Therefore, continuous sampling is required for accurate assessment. During snowmelt, soluble P and other soluble nutrients were disproportionately high compared with snowmelt runoff. Sediments in the Black Creek contain three times the total P and five times the total N found in uneroded soils. (Cassar-FRC)
W82-00135

PREDICTING RUNOFF POLLUTANT REDUCTION IN BUFFER ZONES ADJACENT TO LAND TREATMENT SITES,

North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
M. R. Overcash, S. C. Bingham, and P. W. Westerman.
Transactions of the ASAE, Vol 24, No 2, p 430-435, March-April, 1981. 6 Fig, 5 Tab, 21 Ref.

Descriptors: *Animal wastes, *Land application, *Nonpoint pollution sources, *Water pollution control, Buffer zones, Model studies, Mathematical models, Infiltration, Runoff, Pollution load, Soil types, Rainfall-runoff relationships.

A mathematical model was developed to estimate the proper buffer zone length for preventing non-point source pollution from animal waste application sites. Three major factors were considered: pollutant concentration in runoff, dilution, and infiltration. A family of reduction percentages vs. buffer zone/waste area curves are presented. Soil type significantly affected buffer zone performance. For an infiltration rate/rainfall rate ratio of 0.7, characteristic of clay loam soil, a buffer area/length ratio of 1.0 is required to reduce pollutant concentrations by 90-100%. (Cassar-FRC)
W82-00141

**CHARACTERISATION OF DOMESTIC AND INDUSTRIAL SEWAGE IN SOUTHERN CALIFORNIA COASTAL SEDIMENTS USING NITROGEN, CARBON, SULPHUR, AND URANIUM TRACERS,**
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
R. E. Sweeney, E. K. Kalil, and I. R. Kaplan.
Marine Environmental Research, Vol 3, No 3, p 225-243, July, 1980. 9 Fig, 5 Tab, 15 Ref.

Descriptors: *Mathematical models, *Marine sediments, *Isotopic tracers, Sediments, Isotope studies, Wastewater, Nitrogen, Carbon, Sulfur, Uranium, Sedimentation, Water pollution effects, *San Pedro, California, Path of pollutants.

A degradation-mixing model was developed to aid in the interpretation of geochemical processes occurring in sewage-contaminated marine sediment near San Pedro, California. An effective tracer of sewage discharge in this area was the nitrogen isotope ratio. Uranium enrichment from seawater did not occur in the sediments contaminated by sewage. The uranium content of effluent particles was 18 ppm, while that for uncontaminated sediment was 5 ppm. This allows uranium content to also be a tool in tracing the deposition of the sewage sediment in the marine environment. Cadmium and sulfur, however, were not mobilized during sewage deposition and degradation. Data summarized by Morel et al. (1975) are presented and discussed in terms of the degradation-mixing model. About 30 to 40% of the discharged nitrogen and uranium in the particulates was lost during sedimentation. Cadmium is retained entirely in the sediment, and sulfur is further enriched by in situ reduction of seawater sulfate. (Small-FRC)
W82-00147

**EFFECT OF KAOLIN CONCENTRATION ON DISTRIBUTION COEFFICIENT OF COPPER,**
Maryland Univ. Eastern Shore, Princess Anne. Dept. of Natural Sciences.
G. C. Gupta, and F. L. Harrison.
Water, Air, and Soil Pollution, Vol 13, No 2, p 247-250, June, 1980. 1 Fig, 15 Ref.

Descriptors: *Copper, *Adsorption, *Kaolin, Fate of pollutants, Clays, Metals, Sediments, Mathematical equations, Laboratory studies.

Prior work on adsorption of copper by sediments and clays cannot be compared because a variety of clays and concentrations were used. In this study H-kaolin was equilibrated with Cu64 spiked water, shaken overnight in a constant temperature shaker, filtered through a 0.45 micrometer Millipore membrane, and the partitioning of radioactivity between filtrate and filter measured with a gamma ray well counter. The pH was stable at 6.37-6.42. Adsorption of Cu, expressed as the distribution coefficient, as a function clay concentration decreased sharply from over 7,000 at 10 ppm clay to 2,000 at 150 ppm and 1,2000 at 480 ppm. This curve agrees with other work in which higher adsorption occurs at lower concentrations and reaches an equilibrium at higher concentrations. The higher adsorption at lower concentrations may be caused by higher particle aggregation of the metal with the suspended clay. (Cassar-FRC)
W82-00153

**HYDROLYSIS OF FENITROTHION IN MODEL AND NATURAL AQUATIC SYSTEMS,**
Dept. of Agriculture, Ottawa (Ontario).
R. Greenhalgh, K. L. Dhawan, and P. Weinberger.
Journal of Agricultural and Food Chemistry, Vol 28, No 1, p 102-105, January/February, 1980. 4 Fig, 2 Tab, 18 Ref.

Descriptors: *Fenitrothion, *Natural waters, *Degradation, Pesticides, *Insecticides, Lakes, Photolysis, Microbial degradation, Hydrolysis, Chemical reactions, Fate of pollutants.

Fenetrothion can enter aquatic systems directly or indirectly, from surface runoff, after aerial application to forests. The degradation of fenitrothion, O,O-dimethyl O-(3-methyl-4-nitrophenyl) phosphorothioate, was studied in the dark in buffered distilled water, natural lake water, and buffered lake water. Above pH 8, 3-methyl-4-nitrophenol was formed by specific base catalysis. Below pH 7, demethylfenitrothion was formed by dealkylation. This reaction was temperature dependent. Aminofenitrothion appeared in reaction mixtures involving lake water, but not distilled water; in buffered lake water aminofenitrothion comprised 16% of the reaction products and in natural lake water, 5%. Buffering probably supports growth and activity of degrading microorganisms. Photolysis and microbial degradation are suggested as the main mechanisms for degradation of fenitrothion in natural aquatic systems because the half-life for disappearance in natural lake water (23C and pH 7.5) was 49.5 days in the dark and 1.5-2 days in the field. (Cassar-FRC)
W82-00157

**FENITROTHION SPRAYED ON A POND: KINETICS OF ITS DISTRIBUTION AND TRANSFORMATION IN WATER AND SEDIMENT,**
National Water Research Inst., Burlington (Ontario).
R. J. Maguire, and E. J. Hale.
Journal of Agricultural and Food Chemistry, Vol 28, No 2, p 372-378, 1980. 4 Fig, 3 Tab, 36 Ref.

Descriptors: *Fenitrothion, *Degradation, *Kinetics, Pesticides, *Insecticides, Suspended solids, Sediments, Adsorption, Hydrolysis, Chemical reactions, Volatility, Fate of pollutants, *Ponds, New Brunswick, Canada.

Fenitrothion, O,O-dimethyl O-(p-nitro-m-tolyl) phosphorothionate, sprayed on the surface of a pond in New Brunswick, Canada, to control spruce budworm, volatilized rapidly (half-time, 18 min at 20 degrees C). Concentrations of the insecticide in water, suspended solids, and sediments were below the detectable level two days after spraying. The most persistent degradation products were p-nitro-m-cresol in water (zero concentration reached at 48 hours) and aminofenitrothion in sediments (zero concentration reached in four days). Volatilization from the surface took place in two steps. Following the 'fast' volatilization, in which the fenitrothion probably codistilled with the formulation solvents, a second, slower process of volatilization from the subsurface water began. The half-life of this step was 64 days. Addition of 5 mg per liter of dissolved fulvic acid to the water retarded volatilization to a half-life of greater than 180 days. (Cassar-FRC)
W82-00159

**PHOTOLYSIS OF N-NITROSODI-N-PROPYLAMINE IN WATER,**
Lilly Research Lab., Greenfield, IN.
D. G. Saunders, and J. W. Mosier.
Journal of Agricultural and Food Chemistry, Vol 28, No 2, p 315-319, 1980. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Nitrosamines, *Degradation, *Herbicides, Fate of pollutants, Organic compounds, Nitrogen compounds, Amines, Photolysis, Chemical reactions, Trifluralin, Lakes, Natural waters, Carcinogens, Solar radiation.

Although N-nitroso-di-n-propylamine (NDPA) has not yet been detected in irrigation waters or pond waters, this trace contaminant of the herbicide trifluralin is a potential hazard in natural waters. The photolysis of NDPA was studied in lake water, in distilled water, and in waters buffered to pH 3, 6, and 9. NDPA rapidly degraded in all experiments. Concentrations of 1-100 ppm had little effect on the results. Photolysis rate was independent of pH. After 120 min the major photoproduct was n-propylamine (47-73%), with some di-n-propylamine (2-24%). (Cassar-FRC)
W82-00164

**AMOUNTS AND RELATIVE SIGNIFICANCE OF RUNOFF TYPES IN THE TRANSPORT OF NITROGEN INTO A STREAM DRAINING AN AGRICULTURAL WATERSHED,**
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
A. N. Sharpley, and J. K. Syers.
Water, Air, and Soil Pollution, Vol 15, No 3, p 299-308, April, 1981. 4 Fig, 3 Tab, 31 Ref.

Descriptors: *Runoff, *Nitrogen, Streamflow, *Agricultural watersheds, Watersheds, Agriculture, Agricultural runoff, Nutrients, Nonpoint pollution sources, Pollution load, Solute transport.

This paper reports an investigation of the relationships between flow and concentration of N forms; the sampling frequency required to reliably estimate the loading of N forms; the amounts of N forms transported in surface, accelerated subsurface, and subsurface runoff and stream flow; and the relative significance of the three runoff types to stream flow and nitrogen discharge from a watershed under pasture. The watershed under study was located adjacent to Massey University in Palmerston North, New Zealand. A slight decrease of NO3-N and an increase of particulate N concentrations was noted with increased flow of the runoff and the stream, due to dilution and increased sediment transport, respectively. The concentrations of NO3-N in surface, accelerated subsurface and subsurface runoff and stream flow, average over three years, was 0.3, 6.6, 4.8, and 4.6 mg/liter, respectively, amounting to 0.5, 9.4, 11.6, and 16.8 kg/ha/yr, respectively, transported annually. Although NO3-N accounted for only a minor portion of the total nitrogen transported in surface runoff, it was the major form of nitrogen transported in the other runoff types and in streamflow. Subsurface runoff contributed the major portion of stream discharge and NO3-N, particulate, and total N loadings of the stream. These findings are of interest in the study of non-point pollution of surface waters. (Baker-FRC)
W82-00173

**ELEMENT MASS BALANCES FOR SOUTH CAROLINA COASTAL PLAIN WATERSHEDS,**
South Carolina Univ., Columbia. Dept. of Geology.
L. R. Gardner.
Water, Air, and Soil Pollution, Vol 15, No 3, p 271-284, April, 1981. 1 Fig, 2 Tab, 27 Ref.

Descriptors: *Watersheds, *Chemical properties, Groundwater, *South Carolina, Coasts, Fertilizers, Precipitation, Runoff, *Agricultural chemicals, Path of pollutants, Chemistry of precipitation, Calcium, Solutes, Agricultural runoff.

An attempt was made to relate rainfall chemistry and agricultural and forestry practices to regional variations in water quality among the South Carolina Coastal Plain watersheds. The area is underlain by unconsolidated-to-poorly-consolidated sediments, ranging in age from late Cretaceous to Recent. The average annual precipitation over the Coastal Plain ranges from 114 cm along the western margin to 140 cm along the coast. Runoff from Upper Coastal Plain watersheds averages about 46 cm, compared to 33 cm for Lower Coastal Plain

watersheds. Fertilizers and liming materials appeared to be the major sources for Ca, Mg, K, Cl, and HCO3 inputs, whereas precipitation is the major source for Na and sulfates. Streamflow is the chief mode of output for all these elements. A balance between input and output is evident only for chlorides. Retentions of 50% or more are shown by Ca, Mg, K, HCO3 and SO4, whereas Na shows an apparent net loss. About 25% of the dolomitic liming materials applied to the landscape actually dissolve, and the carbonate chemistry of the Lower Coastal Plain streams is therefore probably largely controlled by seepage of groundwaters from underlying calcareous aquifers. K retention and Na loss may be due to cation exchange reactions on soil clays, whereas sulfate retention is due to reduction to H2S in floodplain environments and soil adsorption. (Baker-FRC)
W82-00175

**CARBON TRANSFORMATIONS IN THE LAND AREAS RECEIVING ORGANIC WASTES IN RELATION TO NONPOINT SOURCE POLLUTION: A CONCEPTUAL MODEL,**
Florida Univ., Sanford. Agricultural Research and Education Center.
K. R. Reddy, R. Khaleel, and M. R. Overcash.
Journal of Environmental Quality, Vol 9, No 3, p 434-442, July-September, 1980. 2 Fig, 8 Tab, 50 Ref.

Descriptors: *Carbon, *Decomposition, Plants, Animal wastes, Water quality, Monitoring, Model studies, Mathematical models, Nonpoint pollution sollution, Soil environment.

The available literature on organic carbon (C) transformations in soils treated with organic wastes was reviewed. A conceptual model to describe the fate of C in the soil-waste system was developed. The effects of soil, environment, and management factors on the rate of C decomposition was determined. The impact of C decomposition on the runoff transport of C and on water quality was described. The organic matter was obtained from three sources: animal waste, plant residues, and native soil organic matter. The model describes decomposition of wastes in two or three phases, assuming first-order kinetics at each phase. The fraction decomposed at each phase was determined graphically. Rapid decomposition of an easily decomposable C fraction in Phase I and II was followed by the decomposition of more resistant C fractions. The amount of C decomposed for plant residues in Phase I was significantly related to the log C/N ratio of the residue, whereas a similar relation was not noted for animal wastes. Decomposition rates were 6-10 times faster during Phase I and II decomposition as compared to Phase III. Kinetic rate constants, calculated at each phase of decomposition, were adjusted for the soil temperature, soil moisture, and method of application. Equations are presented to calculate the transport of waste particles and sediment-associated C in the runoff water. (Baker-FRC)
W82-00179

**MODELING THE FLUX OF ATMOSPHERIC POLYCHLORINATED BIPHENYLS ACROSS THE AIR/WATER INTERFACE,**
Wisconsin Univ.-Madison.
P. V. Doskey, and A. W. Andren.
Environmental Science and Technology, Vol 15, No 6, p 705-711, June, 1981. 4 Tab, 48 Ref.

Descriptors: *Air-water interfaces, *Polychlorinated biphenyls, *Mathematical models, Aroclors, Sampling, Measurement techniques, Deposition, Chemical analysis, Lakes, Lake Michigan.

Many freshwater lakes serve as sinks for polychlorinated biphenyls (PCBs), which are found throughout the environment. However, quantification of the total PCB flux across the air/water interface presents many problems. The total atmospheric PCB burden is analytically underestimated due to insufficient collection of the most volatile PCB fraction. Most quantification methods fail to indicate the extent of PCB mixture weathering. Speciation of airborne PCBs indicates that more than 90% exist in the vapor phase. Indirect calculations based on semiempirical expressions also suggest that particle-bound Aroclors are generally associated with submicrometer-size aerosols. Data from Lake Michigan are used to demonstrate a model of the PCB flux across the air/water interface. The model includes the processes of vapor and particle deposition, volatilization, and bubble ejection. Calculations indicate that atmospheric transport currently plays a major role in the deposition of PCBs in Lake Michigan in comparison with other modes of deposition. The importance of vapor deposition and volatilization is dependent upon the magnitude of the Henry's law constant. The role of bubble ejection in transferring PCBs from freshwater lakes back into the atmosphere is uncertain. A combination of approaches is needed to achieve an accurate picture of the atmospheric PCB flux. (Carroll-FRC)
W82-00193

**BACTERIAL CONTAMINATION OF DRINKING WATER SUPPLIES IN A MODERN RURAL NEIGHBORHOOD,**
Oregon State Univ., Corvallis. Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W82-00198

**PICLORAM DISSIPATION IN A SMALL SOUTHWESTERN STREAM,**
Science and Education Administration, Tucson, AZ.
T. N. Johnsen, and W. L. Warskow.
Weed Science, Vol 28, No 5, p 612-615, September, 1980. 2 Fig, 1 Tab, 23 Ref.

Descriptors: *Picloram, *Streamflow, Degradation, *Herbicides, Dissipation, Environmental effects, Flow, Mixing.

The disappearance of a known amount of picloram (4-amino-3,5,6-trichloropicolinic acid) after injection into a small stream located in semiarid southwestern pinyon-juniper and interior chaparral woodlands was investigated. This herbicide is widely used in the southwest to control a variety of woody plants. The picloram was lost by normal flow actions such as the mixing of fast- and slow-moving water, and the interchange of surface and subsurface water in gravel and sand beds. The herbicide was injected at a concentration of 6.26 ppmw. It was detected in the following amounts in the stream: 0.943 ppmw at 0.8 km, 0.316 ppmw at 1.6 km, 0.014 ppmw at 3.2 km, 0.001 ppmw at 6.4 km, and none further downstream. Photodegradation tests were also performed, and sunlight decomposed 57% of the picloram after 8.8 hr of sunlight exposure. Little herbicide damage was observed on the day following injection, although algae growth may have been limited by the herbicide. (Small-FRC)
W82-00212

**EVALUATION OF THE OVERLAND RUNOFF MODE OF LAND WASTEWATER TREATMENT FOR VIRUS REMOVAL,**
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
S. A. Schaub, K. F. Kenyon, B. Bledsoe, and R. E. Thomas.
Applied and Environmental Microbiology, Vol 39, No 1, p 127-134, January, 1980. 3 Fig, 4 Tab, 12 Ref.

Descriptors: *Viruses, *Wastewater, Land disposal, Runoff, *Overland flow, Primary sludge, Sludge, Secondary wastewater, Advanced wastewater treatment, Bacteria, Bacteriophage, Adsorption, Poliovirus.

This study was conducted on an overland runoff treatment system in Ada, Oklahoma. The system and treatability parameters here were well characterized, and the raw and primary and secondary treated wastewater applied could be examined in identical soils, application regimes, and climatological conditions. Raw, primary, and secondary treated wastewaters were sprayed onto grass-covered 36 meter soil plots of fine sandy loam overlying an impermeable clay subsoil. Tracer bacteriophage f2 was seeded into the applied wastewaters, which were subsequently sampled at several points along the length of the plots. Assay of effluent samples revealed modest tracer virus removals of 30 to 60%. Data from timed experiments indicated that advancement of tracer virus to the bottom of the slopes proceeded at the same rate as wastewater, reaching the plot effluents within 50 to 90 minutes after application. Indigenous enteric virus levels were reduced by about 68 to 85% during migration down the treatment slopes. Soil sampling revealed that, although some f2 virus was found associated with the wastewater-saturated topsoil, little penetration of virus into the soil occurred. Lab soil adsorption studies revealed that poliovirus I was adsorbed much more readily than f2 virus. Comparison of virus removal during overland runoff with chemical removal of wastewater did not reveal any obvious correlations that could be used to predict virus removal. (Baker-FRC)
W82-00220

**STAPHYLOCOCCUS AUREUS IN RURAL DRINKING WATER,**
Oregon State Univ., Corvallis. Dept. of Microbiology.
M. W. LeChevallier, and R. J. Seidler.
Applied and Environmental Microbiology, Vol 39, No 4, p 739-742, April, 1980. 3 Tab, 23 Ref.

Descriptors: *Staphylococcus aureus, *Drinking water, *Rural areas, Well water, Water pollution sources, Plumbing, Chlorination, Water pollution prevention, Public health.

Coagulase-positive Staphylococcus aureus was isolated from over 6% of 320 drinking water specimen during routine monitoring of drinking water quality. Coliforms were detected in 49 of the samples. Only five times were coliforms and S. aureus detected simultaneously. Samples were collected from three points in household water systems to determine the source of S. aureus. Faucet screens were the most common reservoir of the highest S. aureus cell densities. Frequent cleaning of faucet screens, flushing of storage tanks, and, in cases of severe contamination, intermittent chlorination of rural water supplies would help eliminate various contaminants including S. aureus from domestic water supplies. This could lower the possibility of waterborne illness in rural water supplies. Well water was the most common water source in the study. (Small-FRC)
W82-00223

**DISTRIBUTION AND TRANSPORT OF HEAVY METALS IN THE SEDIMENTS OF A SMALL NORTHERN EUTROPHIC LAKE,**
Alberta Environmental Center, Vegreville.
J. W. Moore.
Bulletin of Environmental Contamination and Toxicology, Vol 24, No 6, p 828-833, 1980. 3 Tab, 15 Ref.

Descriptors: *Heavy metals, *Lake sediments, *Mine wastes, Metals, Mercury, Copper, Zinc, Arsenic, Strontium, Titanium, Chromium, Lead, Gold, Organic matter, Lakes, Path of pollutants, Sediments, Tailings, Water quality, Sorption, Distribution patterns.

Concentrations of heavy metals were measured in the sediments of a small, eutrophic lake, which received waste discharges from a gold mine between 1941 and 1949. Tailings in Thompsons Lake, Canadian Northwest Territories, contained an average of 190 micrograms per kg Hg, 57 mg per kg Cu, 93 mg per kg Pb, 100 mg per kg Zn, and 2100 mg per kg Ti. Cr, Sr, and As levels in tailings were much lower. In the sediments, Hg was high (440 micrograms per kg) nearest the mine and decreased with increasing distance away from the mine. Cu and Sr concentrations behaved similarly. Concentrations of Zn, Ti, As, Cr, and Pb in lake sediments were lower than in tailings; for all but Zn and As, the concentrations decreased at distances further from the mine. Evidently, tailings have not yet spread evenly throughout the lake, although the last wastes were deposited 30 years ago. Levels of Hg in water were generally less

than 0.2 mg per cu meter, with values of 2.5 and 0.5 mg per cu meter next to the mine. Concentrations of metals were strongly correlated with one another, indicating that the metals tend to move together. Organic matter in the sediment was 20-37% dry weight near the mine, 62-81% at 0.2 to 1.0 km from the mine, 65-87% at 1.1-2.0 km, and 68-91% at 2.1-3.0 km. There was a strong negative correlation between organic content and all metals but arsenic. (Cassar-FRC)
W82-00235

**REDUCTION, METHYLATION, AND INCORPORATION OF ARSENIC INTO LIPIDS BY THE MARINE PHYTOPLANKTON DUNALIELLA TERTIOLECTA,**
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
J. J. Wrench, and R. F. Addison.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 5, p 518-523, May, 1981. 4 Fig, 23 Ref.

Descriptors: *Arsenic compounds, *Lipids, *Phytoplankton, Dunaliella, Metabolism, Algae, Fate of pollutants, Marine algae, Arsenic.

The chemical forms of arsenic present in marine organisms affect its toxicity. This study is concerned with the reactions only within the first 45 min of exposure of the unicellular marine phytoplankton Dunaliella tertiolecta to As74 labeled arsenate. The algal cells synthesized three polar arsenic metabolites--arsenite, monomethylarsonic acid, and dimethylarsinic acid--and three arsenolipids. A large fraction of the assimilated As appeared in the lipid fraction. Equilibrium of the arsenic metabolites was approached within 30 min of exposure. Two of the arsenolipids were labile in acid solution, producing arsenite as a primary acid hydrolysis product. Acid-labile arsenolipid 1 was hydrolyzed by phospholipase D and was similar chromatographically to a product synthesized from phosphadityl inositol and arsenite. Arsenolipid 2, also an arsenite complex, was categorized as a neutral or zwitterionic glycolipid. Arsenolipid 3, stable on silicic acid columns and not an arsenite, also appeared to be a glycolipid. (Cassar-FRC)
W82-00239

**POLLUTION FROM LAND RUNOFF,**
Great Lakes Basin Commission, Ann Arbor, MI.
W. C. Sonzogni, G. Chesters, D. R. Coote, D. N. Jeffs, and J. C. Konrad.
Environmental Science and Technology, Vol 14, No 2, p 148-153, February, 1980. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Runoff, *Water pollution sources, Lakes, Great Lakes, Agricultural chemicals, Phosphorus, Land use, Chlorides, Municipal wastes, Climates, *Nonpoint pollution sources.

Nonpoint sources of pollution affecting the Great Lakes were identified and the causes cited. Practical remedial measures were considered. Eight areas, representing the full range of land use activities in the basin, were selected for detailed study. Land factors, such as land form, land use intensity, and materials usage, were found to be necessary for inclusion along with general land use when an area is evaluated as a nonpoint pollution source. Land form characteristics include soil texture, soil type, surficial geology, physiography, and soil chemistry. Land use intensity, or degree to which land is developed, has a major impact on water quality. Any land practice that exposes soil to the erosive forces of rainfall and runoff represents an erosion and pollution hazard. High chloride levels were often found along transportation corridors as a result of highway deicing operations and other activities. A number of materials are applied to land in the Great Lakes region, one of the most influential being fertilizers and other agricultural chemicals. Pesticide residues may be carried in the runoff waters. Among the pesticides detected in the study of the Great Lakes were atrazine, simazine, DDT, dieldrin, endosulfan, lindane, endrin, and heptachlor. Guthion, though heavily applied in orchards and found in runoff water, decomposes rapidly. (Baker-FRC)
W82-00253

**MODELING THE RELATIONSHIP BETWEEN DEVELOPMENT AND STORM WATER AND NUTRIENT RUNOFF,**
Louisiana State Univ., Baton Rouge. Coastal Ecology Lab.
For primary bibliographic entry see Field 2A.
W82-00260

**CONCENTRATION AND SIZE OF ASBESTOS IN WATER SUPPLIES,**
Health Effects Research Lab., Cincinnati, OH.
J. R. Millette, P. J. Clark, M. F. Pansing, and J. D. Twyman.
Environmental Health Perspectives, Vol 34, p 13-25, February 1980. 6 Tab, 25 Ref.

Descriptors: *Drinking water, *Asbestos, Pipes, Natural waters, Storms, Potable water, Erosion, Industrial wastes, Stream discharge.

Evidence is presented which suggests that asbestos is a significant contaminant in a number of water supplies in the United States. Chrysotile, a serpentine mineral, is the most common asbestos variety found in water supplies, but some amphiboles have also been identified. The amphibole crocidolite has been found in some waters distributed through asbestos cement pipe. Amphibole fibers in Lake Superior have been primarily of the cummingtonite-grunerite series, of which amosite, a commercial asbestos, is a member. Amphiboles of the tremolite-actinolite series were found in the Pacific Northwest drinking water supplies. No fibers of anthrophyllite have been reported. Filtration and coagulation can control asbestos fibers. To provide fiber size distribution data on asbestos in drinking water, only direct transfer preparation methods with transmission electron microscopy are used. Available data on asbestos concentrations in United States water supplies as determined by transmission electron microscopy are tabulated. In natural water systems the weather plays an important part in varying the concentration of asbestos fibers in water over time. The erosion of natural serpentine rock and of asbestos waste piles undoubtedly increases or decreases depending on rainfall and stream flow. Current data suggests that the consumer is not exposed to constant concentrations of asbestos fibers above one million per liter in most cases. Fibers contributed by natural erosion are generally shorter than those contributed by asbestos cement pipe. (Baker-FRC)
W82-00262

**PREDICTIONS FOR PARTICLE DEPOSITION ON NATURAL WATERS,**
Battelle Pacific Northwest Labs., Richland, WA.
S. A. Slinn, and W. G. N. Slinn.
Atmospheric Environment, Vol 14, No 9, p 1013-1016, 1980. 2 Fig, 16 Ref.

Descriptors: *Deposition rates, *Aerosols, *Air-water interfaces, Air pollution, Natural waters, Turbulence, Particle size, Wind, Model studies, Fate of pollutants.

A simple model is presented for investigating the influence of particle growth on particle deposition on natural waters. If particle growth by water vapor condensation occurs in the humid region adjacent to the air-water interface, then the deposition velocity for particles with dry radii of 1 micrometer is independent of particle size and equal to the limiting value set by atmospheric turbulence. A formula for calculating deposition velocity is given. (Cassar-FRC)
W82-00264

**A COMPARISON OF NITROGEN IN SHALLOW GROUND WATER FROM SEWERED AND UNSEWERED AREAS, NASSAU COUNTY, NEW YORK, FROM 1952 THROUGH 1976,**
Geological Survey, Towson, MD.
B. G. Katz, J. B. Lindner, and S. E. Ragone.
Ground Water, Vol 18, No 6, p 607-616, November-December, 1980. 7 Fig, 5 Tab, 37 Ref.

Descriptors: *Groundwater, *Nitrogen, *Hydrogeology, *Landfills, *Streams, Sewage treatment, Leachate, Water quality, Ammonium, Toxicity, Management planning, Water sampling, Precipitation, Soil water, Water table, *Nassau County, New York.

Median nitrogen concentrations of groundwater and water from streams in Nassau County, New York were statistically analyzed on an areal and temporal basis and by individual well to compare concentrations of nitrogen in ground water beneath sewered and unsewered areas. The predominant contributions of nitrogen in groundwater in 1976 were from nonpoint sources such as cesspool effluents and domestic fertilizers. Other significant sources are exfiltration from sewers, rainfall, overland runoff to recharge basins, agricultural fertilizers, animal wastes, landfills, and sewage-treatment plants. Extensive future monitoring is necessary to account for the lack of a significant difference between nitrate concentrations of sewered and unsewered areas. (Titus-FRC)
W82-00277

**AN EVALUATION OF SOURCES OF NITROGEN AS CAUSES OF GROUND-WATER CONTAMINATION IN NASSAU COUNTY, LONG ISLAND,**
Cornell Univ., Ithaca, NY. Center for Environmental Research.
K. S. Porter.
Ground Water, Vol 18, No 6, p 617-625, November-December, 1980. 7 Fig, 4 Tab, 35 Ref.

Descriptors: *Groundwater, *Nitrogen, *Hydrogeology, *Landfills, *Streams, Sewage treatment, Leachate, Water quality, Ammonium, Toxicity, Management planning, Water sampling, Precipitation, Soil moisture, Water table, *Nassau County, New York.

The sources of nitrogen in Nassau County and their relative magnitudes, obtained from routine surveys, are evaluated. Two principal sources of nitrogen are human waste water and fertilized turf. The partial concentrations produced by fertilizers are sufficiently high, relative to those produced by human waste water, to produce considerable masking of the effects of sewerage. This masking will be compounded when additional sources such as precipitation and domestic animals are also included. Because of this, management of one source may not be effective. Management of water pollution sources other than sewerage should be considered. (Titus-FRC)
W82-00279

**NATURAL ABUNDANCES OF 15N AS A SOURCE INDICATOR FOR NEAR-SHORE MARINE SEDIMENTARY AND DISSOLVED NITROGEN,**
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
R. E. Sweeney, and I. R. Kaplan.
Marine Chemistry, Vol 9, No 2, p 81-94, April, 1980. 7 Fig, 4 Tab, 28 Ref.

Descriptors: *Marine sediments, *Nitrogen, *Isotope studies, Sediments, Coastal waters, Organic matter, Water pollution sources, Ammonium, *Santa Barbara basin, California.

Delta nitrogen-15 (15N) values for total nitrogen and dissolved ammonium were measured in Santa Barbara Basin sediment to determine the sources of nitrogen in marine sediments. Organic matter originating in the euphotic zone of the ocean may have a distinctive nitrogen isotope composition when compared to organic matter originating in terrestrial soils. Nitrogen isotope ratios were measured for 42 sediment samples of total nitrogen and 38 dissolved pore-water ammonium samples from Santa Barbara Basin sediment cores. Delta-15N values ranged from 2.89 to 9.4%, with a mean of 6.8% while pore water ammonium values ranged from 8.2 to 12.4% with a mean of 10.2%. The dissolved ammonium in the pore water is thought to be produced by bacterial degradation of marine organic matter. The isotopic ratio for terrestrially derived nitrogen is about 2%, and for marine derived is about 10%. (Small-FRC)
W82-00283

**VIRAL TRANSPORT THROUGH SOIL COLUMNS UNDER CONDITIONS OF SATURATED FLOW,**
Texas Univ. Center for Applied Research and Technology at San Antonio.
S. W. Funderburg, B. E. Moore, B. P. Sagik, and C. A. Sorber.
Water Research, Vol 15, No 6, p 703-711, 1981. 1 Fig, 5 Tab, 22 Ref.

Descriptors: *Viruses, *Soil types, *Adsorption, *Land disposal, Wastewater disposal, Path of pollutants, Fate of pollutants, Saturated flow, Organic matter, Cation exchange, Clays, Loam.

Movement of poliovirus 1, reovirus 3, and bacteriophage OX174 was studied in eight soils with a wide range of properties--cation exchange capacity, organic carbon content, pH 5.7-8.3, silt and clay content, bulk density, and specific surface area. Soils were sampled to a depth of 100 cm and packed into cylinders 10 cm in diameter, each containing one-third of the soil profile length. Columns were flooded with wastewater-virus mixture followed by distilled water for five complete cycles. Virus elution was cyclical. Total number of virus eluted was affected by differences in soil properties. Poliovirus retention in the soil was greatest in soils with high cation exchange capacity values, low organic matter and clay content. OX174 retention was greatest in soils with high organic carbon, high residence time in combination with low soil pH or percent clay. Cation exchange capacity in combination with either soil pH or specific surface area were important in reovirus retention. In general, agricultural type soils were most suitable for adsorbing enteric viruses from land-applied wastewater. (Cassar-FRC)
W82-00295

**DEPOSITION OF HEAVY ELEMENTS ON BELGIAN AGRICULTURAL SOILS,**
Laboratoire de Chimie Inorganique et Nucleaire, Louvain (Belgium).
J-L. Navarre, C. Ronneau, and P. Priest.
Water, Air, and Soil Pollution, Vol 14, p 207-213, 1980. 1 Fig, 2 Tab, 21 Ref.

Descriptors: *Soil contamination, *Heavy metals, Metals, Fertilizers, Agriculture, *Belgium, Path of pollutants, *Agricultural chemicals, Farms, Air pollution, Water pollution sources, Precipitation, Rainfall, Deposition, Fallout.

Wet plus dry deposition processes contributed more heavy metals to Belgian agricultural soils than did chemical fertilizers. Sampling was conducted for one year in 19 purely rural sites as far removed as possible from obvious contamination sources: chimneys, roads, etc. Metals clearly attributable to human origin were Zn, As, Se, Hg, Pb, Cd, and Sb. The sea atmosphere was responsible for the higher levels of Zn (from corroded roofing), Br, and Na found at seaside sites. Certain other metals reached higher levels near factories emitting these materials. Cd, Cr, and Ba were relatively uniform throughout the country. (Cassar-FRC)
W82-00306

**DISTRIBUTION OF OBLIGATELY OLIGOTROPHIC BACTERIA IN LAKE BIWA,**
Kyoto Univ. (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W82-00346

**BEHAVIOR OF DDT, KEPONE, AND PERMETHRIN IN SEDIMENT-WATER SYSTEMS UNDER DIFFERENT OXIDATION-REDUCTION AND PH CONDITIONS,**
Louisiana State Univ., Baton Rouge.
R. P. Gambrell, C. N. Reddy, V. Collard, G. Green, and W. H. Patrick, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-213266, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-81-038, July 1981. 3 p.

Descriptors: *Pesticide residues, *DDT, *Kepone, *Permethrin, *Hydrogen ion concentration, *Redox potential, Sediments, Soil types, Aerobic conditions, Anaerobic conditions, Degradation, Chlorinated hydrocarbons.

The effects of physicochemical conditons on the persistence of pesticide residues were investigated to improve prediction of the fate and potential impacts of residues in various environmental compartments. Three pH levels, ranging from moderately acidic to mildly alkaline, were studied for each compound. Four redox potentials(-150,50,250, and 450 mv) ranging from strongly reduced (anaerobic) to well oxidized (aerobic) were studied. The insecticide-substrate combinations included in the project were DDT in a Mobile Bay (Mobile, Alabama) sediment material, Kepone in the sediment material of a tributary of the James River (Hopewell, Virginia) and Permethrin in an Olivier soil material (Baton Rouge, Louisiana). Sample aliquots were removed from the laboratory microcosms to determine the recovery of the added compounds with time. A substantial redox potential effect was noted for DDT where recovery decreased from the spiking level of around 25 ppm to less than 10% of the spiking level for DDT where recovery decreased from the spiking level of around 25 ppm to less than 10% of the spiking level n). A less rapid loss of DDT was noted at 50 mv (modcrately reduced condition), but the pesticide appeared stable under better oxidized conditions during the 45-day incubations. The levels of Kepone recovered did not change appreciably during 56 days of incubation under any of the combination of imposed pH and redox potential conditions. The recovery of Permethrin was affected by both pH and redox potential conditions over 25-day incubations. Unlike DDT, Permethrin was lost more rapidly under oxidizing conditions. Increasing pH enhanced the loss of this compound over the range of redox potential levels studied. (Brambley-SRC)
W82-00382

**ASSESSMENT OF OIL SHALE RETORT WASTEWATER TREATMENT AND CONTROL TECHNOLOGY - PHASES I AND II,**
Monsanto Research Corp., Dayton, OH.
J. R. Klieve, G. D. Rawlings, and J. R. Hoeflin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-187288, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S7-81-081, May 1981. 5 p, 3 Fig.

Descriptors: *Oil shale, *Wastewater treatment, *Water pollution sources, *Wastewater composition, *Water reuse, Mine drainage, Leachates, Trace metals, Organic compounds, Dissolved solids.

Phases I and II of a five-phase project comprise surveys of literature and other information sources to obtain data on oil shale retorting technologies, wastewater sources and characteristics, potential wastewater uses, and potentially applicable treatment technologies. In-situ oil shale retorting is the source of three waste streams - mine water, retort water, and gas condensate - and surface retorting also produces three waste streams - gas condensate, product water, and spent shale pile leachate. Mine water is known to contain high levels of alkalinity, COD, chloride, fluoride, sulfate, boron and sodium, and significant trace metals. Retort wastewater and product wastewater contain high levels of most pollutants identified. Gas condensates contain high levels of ammonia, alkalinity, and organics, but lower levels of trace metals than the retort wastes. High levels of organics, TDS, sulfate and sodium have been found in spent shale pile leachate. Research on treatment of these waste streams has shown that a number of treatments are possible, depending on the intended use of the treated water, but that the research has generally been small-scale, and that there are significant unresearched areas. (Brambley-SRC)
W82-00390

**HUMAN USE IN A DISPERSED RECREATION AREA AND ITS EFFECT ON WATER QUALITY,**
Pacific Northwest Forest and Range Experiment Station, Seattle, WA.
H. H. Christensen, R. E. Pacha, K. J. Varness, and R. F. Lapen.
In: Recreational Impact on Wildlands Conference Proceedings, October 27-29, 1978, Seattle, Washington. Forest Service, Pacific Northwest Region, Portland, Oregon, 1979. p 107-119, 1 Fig, 4 Tab, 38 Ref.

Descriptors: Wilderness areas, *Recreation, *Camping, *Water quality, *Recreation wastes, *Environmental effects, Camp sites, Coliforms, Human wastes, Feces, Water pollution sources, Rainfall.

Potential problems are associated with increases in dispersed outdoor recreation. This study was conducted to determine the effects camping, style of camping, self-contained parties, human waste disposal, and rain have on water quality. Two camping sites were selected, one downstream from the other, in the Greenwater watershed, Washington. The campsites were close to the water, with high frequency and heavy concentration of human use, and had no formal, sanitary facilities, and were studied from May 1975 - July 1976. Few vehicles with self-contained toilets were used so most human waste was deposited on the ground around the sites. Total coliforms at the upstream site ranged from 2-6/100 ml and 2-14/100 ml at the downstream site, well within the range for general recreation and esthetic enjoyment but above the acceptable level for drinking water. The higher levels were associated with the weekend when more campers were present. The coliform counts were not lower when self-contained vehicles were present. The bacteria were rapidly transmitted to the river water, even in dry periods. Site differences could play a part in the differences observed, and there is a dilution factor involved at the downstream site. (Brambley-SRC)
W82-00393

**WATER IN THE ELIZABETHTOWN AREA - A STUDY OF LIMESTONE TERRANE IN NORTH-CENTRAL KENTUCKY,**
Geological Survey, Louisville, KY. Water Resources Div.
T. W. Lambert.
Geological Survey Water-Resources Investigations 79-53 (open-file report) 1979. 81 p, 23 Fig, 4 Plates, 16 Tab, 44 Ref.

Descriptors: *Groundwater, *Surface water, *Water quality, *Limestone, Carbonate rocks, Karst, Aquifers, Wells, Water level, Springs, Groundwater movement, Surface water-groundwater relations, Chemical analysis, Trace elements, Streamflow, Low flow, Floods, Climatic data, *Kentucky, Elizabethtown, Nolin River, *Available water.

An inventory of the water resources of a 240-square-mile area in north-central Kentucky is reported. It includes water distribution, chemical quality, water use, and principles of water occurrence and availability, and references. Nolin River is the only major stream in the area. Two of its tributaries, Valley Creek and North Fork Nolin River, have water withdrawn for public supply by Elizabethtown and Hodgenville. The quality of the water from the streams is typical of a limestone terrane. Ground water is also used for public supplies by Elizabethtown and Hodgenville and by two industrial plants. Many springs have flows of more than 0.25 cubic foot per second. Except for stock water, only three springs serve as a water source. Water from wells and springs is typical of limestone terrane. (USGS)
W82-00413

**HYDROGEOLOGIC DATA FOR ROCKY CREEK LANDFILL AND ADJACENT AREA, NORTHWEST HILLSBOROUGH COUNTY, FLORIDA, 1969-73,**
Geological Survey, Tallahassee, FL. Water Resources Div.
A. D. Duerr, and J. W. Stewart.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $9.75 in paper

copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1291, 1981. 72 p, 3 Fig, 9 Tab, 4 Ref.

Descriptors: *Geohydrology, *Landfills, Hydrologic data, *Water quality, Waste disposal, Observation wells, Well data, Water level, Lithologic logs, Water analysis, Nitrogen, Phosphorus, Metals, Trace elements, Biochemical oxygen demand, Carbon, Coliforms, *Florida, Hillsborough County, *Leachates, Groundwater pollution.

Well location and construction data are summarized for 222 wells in the Rocky Creek landfill and adjacent area in northwest Hillsborough County. Most of the data are for 92 wells within the immediate vicinity of the landfill. Water-quality data are presented for 78 wells and 9 surface-water sites. Water-level data for 133 wells penetrating the surficial and Floridan aquifers and lithologic logs for 35 wells are also presented. (USGS)
W82-00417

**RADIONUCLIDE CONCENTRATIONS IN STREAMS IN THE UPPER BLACKFOOT RIVER BASIN, SOUTHEASTERN IDAHO,**
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 5A.
W82-00418

**WATER LEVEL DATA FOR WELLS IN AND NEAR BURIAL GROUND 3, OAK RIDGE NATIONAL LABORATORY, TENNESSEE, 1975-1979,**
Geological Survey, Knoxville, TN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-00423

**PRELIMINARY EVALUATION OF GROUNDWATER CONTAMINATION BY COAL-TAR DERIVATIVES, ST. LOUIS PARK AREA, MINNESOTA,**
Geological Survey, St. Paul, MN. Water Resources Div.
M. F. Hult, and M. E. Schoenberg.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $24.25 in paper copy, $19.50 in microfiche. Geological Survey Open-File Report 81-72, January 1981. 57 p, 18 Fig, 6 Plates, 4 Tab, 41 Ref.

Descriptors: Groundwater, *Water quality, *Groundwater pollution, Water pollution sources, Chemical wastes, Aquifers, Glacial drift, Bedrock, Geohydrology, Aquifer characteristics, Wells, Water level fluctuations, Withdrawal, Groundwater movement, Flow rates, Path of pollutants, Infiltration, Chemical analysis, *Minnesota, St. Louis Park, *Coal-tar derivatives, Industrial wastewater.

Operation of a coal-tar distillation and wood preserving plant for 1918-72 in St. Louis Park, Minnesota, resulted in ground-water contamination. This report presents the results of the first year (1979) of an ongoing study. By 1932, water in the Prairie du Chien-Jordan aquifer, the region's major source of ground water, was contaminated 3,500 feet from the plant. The hydraulic characteristics of the Prairie du Chien-Jordan aquifer, its long contamination history, and fluctuating pumpage combine to creat a complex distribution of coal-tar derivatives observed in the aquifer. The Prairie du Chien-Jordan aquifer underlies the area at depths of 250 to 500 feet and is overlain by two bedrock aquifers (Platteville and St. Peter), two confining beds (Glenwood and basal part of St. Peter), and 70 to 100 feet of glacial drift. Multiaquifer wells in the area have permitted contaminated water from near-surface aquifers to flow downward into the Prairie du Chien-Jordan aquifer. Flow rates of 20 to 150 gallons per minute from the shallower aquifers into the Prairie du Chien-Jordan aquifer were observed in five wells. In the drift, a hydrocarbon fluid phase is moving vertically downward relative to the aqueous phase. Dissolved constituents in the drift and Platteville aquifer, the uppermost bedrock unit over most of the area, have moved at least 4,000 feet. Low-molecular-weight compounds are moving preferentially through the drift and Platteville aquifer system. (USGS)
W82-00430

**ENVIRONMENTAL CONTROL TECHNOLOGY FOR THE FLASH HYDROPYROLYSIS OF COAL,**
Brookhaven National Lab., Upton, NY. Process Sciences Div.
For primary bibliographic entry see Field 5D.
W82-00435

**COMPARATIVE STUDY ON ORGANIC CONSTITUENTS IN POLLUTED AND UNPOLLUTED INLAND AQUATIC ENVIRONMENTS - I. FEATURES OF HYDROCARBONS FOR POLLUTED AND UNPOLLUTED WATERS,**
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
G. Matsumoto, and T. Hanya.
Water Research, Vol 15, No 2, p 217-224, February, 1981. 4 Fig, 3 Tab, 25 Ref.

Descriptors: *Organic compounds, *Water pollution sources, *Industrial wastes, Water pollution, Path of pollutants, Suspended solids, Aquatic environment, Fossil fuels, Pollutant identification, *Japan, Water analysis.

The hydrocarbon constituents of polluted river waters from the Tokyo area and unpolluted water bodies from the Ogasawara Islands were compared. In the river waters from the Tokyo area, n-alkanes with carbon chain lengths of 12 to 36, squalane and unresolved complex mixtures of hydrocarbons (UCMH) were found at levels of 0.026-14, 0.004-1.7, and less than 5-290 micrograms/liter, respectively. In the waters of the Ogasawara Islands, fro, 12-37 carbon compounds were found at levels of 0.042 5o 4.0 micrograms/liter. The presence of squalane, UCMH and even-carbon numbered n-alkanes were associated with artificial hydrocarbon sources such as industrial wastes, fossil fuels and their products. Odd carbon numbered n-alkanes were more predominant in the unpolluted waters, and originated mostly from algae and higher plants. Squalane and UCMH make up the major portion of the n-alkanes identified in the water samples and are associated with particulate matter in both polluted and non-polluted waters. (Geiger-FRC)
W82-00453

**ENTERIC BACTERIAL CONCENTRATIONS IN RESERVOIR FEEDER STREAMS: BASE-FLOW CHARACTERISTICS AND RESPONSE TO HYDROGRAPH EVENTS,**
Leeds Univ. (England). School of Geography.
A. McDonald, and D. Kay.
Water Research, Vol 15, No 8, p 961-968, August, 1981. 4 Fig, 3 Tab, 24 Ref.

Descriptors: *Enteric bacteria, *Coliforms, *Catchment areas, Watersheds, Hydrographs, Water quality, Rainfall, Precipitation, Streams, Path of pollutants, Thruscross Reservoir, England.

The relationship between coliform bacterial concentration and stream hydrology was investigated within two multiple-use Pennine catchments. The River Washburn and the Capelshaw Beck catchments are located on feeder streams to the Thruscross Reservoir in northern England. The first sampling program defined the background diurnal fluctuations, while the second phase defined the bacterial concentration during a total of 11 hydrograph events. During each hydrograph event on Capelshaw Beck an increase in total coliform and E. coli concentrations occurred at statistically significant levels. During the six River Washburn hydrographs, total coliforms increased significantly on five occasions, and E. coli increased significantly on four occasions. E. coli concentration during high flow conditions in both of the streams exceeded guidelines for direct contact recreational activities. The store of organisms may be located in bottom sediments, fecal material along the shore, or soil. It should be noted that management practices which affect the hydrological response of a catchment to rainfall are likely to cause changes in the enteric bacterial concentration of catchment streams. (Small-FRC)
W82-00462

**UNDERSTANDING ACID RAIN,**
S. Budiansky.
Environmental Science and Technology, Vol 15, No 6, p 623-624, June, 1981.

Descriptors: *Acid rain, *Sampling, *Pollutant identification, Precipitation, Rainfall, Water pollution effects.

Acid rain is a complex phenomenon which involves almost every component of the biosphere. The intensity and effects of acid rain may be affected by varying weather, varying soils, the presence of other pollutants, and species differences. Investigations of the effects of meteorological factors on amounts of chemical wet deposition have identified a number of systematic relationships. Cold fronts and squall lines, thunderstorms, and summer rainfall were all found to be associated with increased concentrations of hydrogen plus ions and sulfates. A considerable proportion of the available data on acid rain, both current and historical, is disjointed and based on inadequate sampling procedures. Much of the data does not include direct measurements of pH. Methods used to measure dry deposition are particularly inadequate, relying on such surrogate collectors as plastic buckets, which are incapable of measuring dry gaseous deposition. Study of the effects of acid rain on individual species often ignores the overall effect of the pollutant on the ecosystem as a whole and the effects of multiple pollutants on an individual species. Also, the amount of acidic material accumulated and absorbed into the soil will be affected by such subsequent events as runoff and snow melts. (Carroll-FRC)
W82-00479

**ALKYLPYRIDINES IN SURFACE WATERS, GROUNDWATERS, AND SUBSOILS OF A DRAINAGE LOCATED ADJACENT TO AN OIL SHALE FACILITY,**
Battelle Pacific Northwest Lab., Richland, WA.
R. G. Riley, T. R. Garland, K. Shiosaki, D. C. Mann, and R. E. Wildung.
Environmental Science and Technology, Vol 15, No 6, p 697-701, June, 1981. 3 Fig, 1 Tab, 16 Ref.

Descriptors: *Oil shale, *Alkylpyridines, *Hydrocarbons, Organic compounds, Bases, Solutes, Industrial wastes, Subsoil, Groundwater pollution, Surface water, Pollutants, Path of pollutants, Rifle, *Colorado.

Studies were conducted at the Department of Energy's Anvil Points Oil Shale Facility at Rifle, Colorado, to determine the concentration of water-soluble organic compounds in materials disposed of or stored at the site and in surface waters, ground waters, and subsoils above and below the site. Water from seeps and alluvial groundwaters downstream of the retorted shale disposal pile were found to have higher levels of total dissolved organic carbon than those upstream of the pile. Analysis of samples from one seep and one well below the disposal pile which had an odor similar to that of shale oil and retort water showed that alkylpyridines were present in these waters at 30.8 and 4.1 micrograms per milliliter, respectively. Surface waters of the stream below the seep were found to contain trace concentrations of alkylpyridines. Alkylpyridines were not detected in a sample of surface sediment from the stream located adjacent to the seep discharge, but were found with depth in cores of subsoil collected adjacent to the well containing alkylpyridines. While alkylpyridines were detected in retort water and in an aqueous extract of shale oil, they were not detected in aqueous extracts of raw shale, in retorted shale, nor in Prudhoe Bay crude oil. The presence of alkylpyridines in these samples in which such other water-soluble compounds as organic acids and phenols were absent suggests that the alkylpyridines were less subject to sorption on the soil or were more persistent during hydraulic transport. These compounds may be unique to shale oils,

perhaps allowing their use as diagnostic indicators of water in contact with shale oils at sites of oil shale production and processing. (Carroll-FRC)
W82-00481

INCIDENCE OF VIBRIO ALGINOLYTICUS AND BACTERIA OF SANITARY SIGNIFICANCE IN THE BERING SEA,
Food and Drug Administration, Seattle, WA.
For primary bibliographic entry see Field 5A.
W82-00490

MICROPLATE TECHNIQUE FOR DETERMINING ACCUMULATION OF METALS BY ALGAE,
Syracuse Univ., NY. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W82-00492

EFFECTS OF MOISTURE CONTENT ON LONG-TERM SURVIVAL AND REGROWTH OF BACTERIA IN WASTEWATER SLUDGE,
BDM Corp., Albuquerque, NM.
For primary bibliographic entry see Field 5E.
W82-00493

SURVIVAL OF ENTEROVIRUSES IN RAPID-INFILTRATION BASINS DURING THE LAND APPLICATION OF WASTEWATER,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5D.
W82-00496

TOXICITY AND ECOLOGICAL SIGNIFICANCE OF TRACE ELEMENTS IN AQUATIC ENVIRONMENTS,
Tennessee Univ., Knoxville.
E. V. Kalmaz.
Journal of Environmental Sciences, Vol 23, No 5, p 24-27, September/October, 1980. 1 Fig, 25 Ref.

Descriptors: *Toxicity, *Trace metals, *Contamination, *Water pollution, *Bioaccumulation, *Organic compounds, Stream pollution, Metals, Aquatic animals, Fish physiology, Food chains, Adsorption, Uptake, Ecosystems, Aquatic environment, Ecological effects.

The ecological signficance of trace elements in aquatic environments is discussed. To develop models for predicting the behavior of trace elements in aquatic systems, it is necessary to distinguish the various forms of chemical and physical states, such as solubility, adsorption capability, particle size, reactivity with other compounds and complex formation. Such characteristics determine the elements' availability to aquatic animals and plants. Sediment is a major source and sink for most trace elements. However, trace element concentrations vary over time and on a macro- and microgeographic scale. Bioconcentration factors tend to be higher for trace elements complexed with organic compounds and higher in aquatic than terrestrial systems. The present technology is not sufficient to quickly, inexpensively, and conclusively seek out a particular element, predict the effects of various dose levels and understand its behavior in aquatic environments. (Titus-FRC)
W82-00498

## 5C. Effects Of Pollution

TOXICITY OF MOUNT ST. HELENS ASH LEACHATE TO A BLUE-GREEN ALGA,
Geological Survey, Lakewood, CO. Water Resources Div.
D. M. McKnight, G. L. Feder, and E. A. Stiles.
Available from Branch of Distr., USGS, 604 Pickett St. Alexandria, VA 22304. Geological Survey Circular 850-F, 1981. 14 p, 6 Fig, 4 Tab, 9 Ref.

Descriptors: *Toxicity, *Cyanophyta, *Volcanoes, *Leachates, Algal toxins, Bioassay, Lakes, Organic compounds, Dissolved solids, Trace metals, Water quality, Chemical analysis, Water pollution effects, *Washington, *Mount St. Helens, Richland, Moses Lakes, *Volcanic ash.

This report describes laboratory studies with volcanic ash intended to aid the assessment of the possible effects of ash presence on the blue-green algal populations in lakes. Bioassays using leachate from volcanic ash of the May 18, 1980, eruption of Mount St. Helens, Wash., indicate that leachate derived from ash collected at Richland, Washington, is toxic to the blue-green alga Anabaena flos-aquae, whereas leachate from ash collected at Moses Lake, Wash., is not. The difference in the toxicity of the two leachates may be attributable to differences in concentration of cationic-exchangeable, dissolved, organic compounds. Seventeen percent of the dissolved organic carbon from the leachate from ash collected at Richland was retained on a cation-exchange column, whereas only six percent of the dissolved organic carbon from the leachate from ash collected at Moses Lake was retained. Anabaena flos-aquae cultures spiked with dilutions of 1 to 250 of leachate derived from volcanic ash collected at Richland showed toxic effects, whereas cultures spiked with a 1 to 25 dilution of leachate derived from ash collected at Moses Lake showed no toxic effects. The toxic components of the volcanic ash are nonuniformly distributed over the ash fall area. Preliminary data indicate that the toxic components may belong to one or more of the following classes of substances: (1) cationic organic compounds such as amines; (2) highly hydrophobic (sparingly soluble) organic compounds such as phenols that interact with and are retained by the cation-exchange-resin matrix; or (3) metal-organic complexes that are retained by interaction of the metal with the cation-exchange resin. (USGS)
W82-00001

EFFECTS OF THE MOUNT ST. HELENS ERUPTION ON THE BENTHIC FAUNA OF THE TOUTLE RIVER, MUDDY RIVER, AND PINE CREEK DRAINAGE BASINS, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
L. A. Fuste.
Available from the Branch of Distr., USGS, 604 Pickett St. Alexandria, VA 22304. Geological Survey Circular 850-H, 1981. 13 p, 3 Fig, 5 Tab, 6 Ref.

Descriptors: *Benthic fauna, *Volcanoes, *Ecosystems, Streams, Lakes, Sampling, Aquatic insects, Mayflies, Midges, Invertebrates, Aquatic habitats, *Washington, *Mount St. Helens, Toutle River, Muddy River, Pine Creek, Volcanic ash, *Ecological effects, *Surface water.

Benthic invertebrate samples were collected in the Toutle River, Muddy River, and Pine Creek drainage basins on March 28-30, 1980, to document pre-eruption conditions in watersheds surrounding Mount St. Helens in the event of a major eruption. A highly diverse fauna was present at all sampling sites. Mayfly and midge (chironomid) larvae were the most numerous organisms. An attempt was made to classify the streams studied according to the functional role of organisms in the processing of organic matter. It was hypothesized that many of the organisms exhibiting multiple functional roles in processing of organic matter were predominantly detritovores. This classification was then compared to a conceptual stream ecosystem model. The volcanic eruption of May 18 destroyed most, if not all, of the benthic fauna present at the sites sampled. The cataclysmic events that took place during the explosion modified the topography to the point of eliminating some of the watersheds, while in others the riparian vegetation was scoured out, along with the natural substrate of the streams. The potential for recolonization of stream benthos appears to be relatively high because of the creation of new habitats near backwaters and pools from springs which were exposed by the scouring action of the mudflows. It is believed that these 'seed habitats,' in conjunction with downstream drift from unaffected tributaries and aerial oviposition by winged adults of aquatic insects, will be the principal sources of stream benthos for the affected streams in the coming years. (USGS)
W82-00005

EFFECTS OF MOUNT ST. HELENS ERUPTION ON SELECTED LAKES IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2H.
W82-00006

RECONNAISSANCE OF THE EFFECT OF LANDFILL LEACHATE ON THE WATER QUALITY OF MARSHALL BROOK, SOUTHWEST HARBOR, HANCOCK COUNTY, MAINE,
Geological Survey, Boston, MA. Water Resources Div.
B. P. Hansen.
Geological Survey Open-File Report 80-1120, 1980. 13 p, 3 Fig, 5 Tab, 14 Ref.

Descriptors: *Landfills, *Leachates, *Water quality, Surveys, Water pollution sources, Path of pollutants, Ammonia, Dissolved oxygen, Benthos, Specific conductivity, Chemical analysis, *Maine, *Marshall Brook, Southwest Harbor, Hancock County.

This report presents the results of a reconnaissance of surface-water quality in the Marshall Brook basin in Southwest Harbor, Maine. A small stream (2.2-square-mile drainage area) receiving leachate from a landfill was studied from August through November 1979 to determine the impact of the leachate on water quality. The presence of unionized ammonia, considered toxic to some aquatic vertebrates, was indicated in samples taken from sections of the stream affected by leachate. Some dissolved oxygen values did not meet the criteria for the protection of aquatic life. Many other dissolved constituents were present in elevated concentrations in the leachate-influenced reaches of the stream. Flow-data comparisons indicate that streamflow less than that observed will occur approximately 20% of the time. Leachate-affected stream conditions may deteriorate further during such low streamflow. Several areas with the potential for large sediment yields are present in the basin. (USGS)
W82-00013

WATER QUALITY MANAGEMENT STUDIES, LAKE SEMINOLE, APRIL-NOVEMBER 1978.
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 6G.
W82-00051

ASSESSMENT OF 1978 WATER QUALITY CONDITIONS IN THE UPPER POTOMAC ESTUARY,
Environmental Protection Agency, Annapolis, MD. Annapolis Field Office.
L. J. Clark, S. E. Roesch, and M. M. Bray.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-212228, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-903/9-80-002, March 1980. 102 p, 30 Fig, 12 Tab, 8 Ref, Append.

Descriptors: *Water quality, *Estuarine environment, *Water pollution effects, *Algal growth, Nitrogen, Phosphorus, Nutrients, Eutrophication, Dissolved oxygen, Effluents, Mathematical models, Chlorophyll a, Urban areas, Estuaries, *Potomac River estuary, District of Columbia area.

The challenge to improve the Potomac Estuary through reduction of point source pollutant loadings necessitates the periodic collection of field data to assess trends and the scope of existing water quality stresses. Ongoing efforts to improve and refine predictive mathematical models impose another need for extensive water quality information. The second successive intensive monitoring program in the Potomac Estuary was performed during the period July to September 1978. This program consisted of three distinct elements: slack tide sampling over a 65 mile reach of the upper estuary; sampling of the effluents at the eight major wastewater treatment plants in the Washington Metropolitan Area; and special field and labora-

tory studies which addressed specific aspects of the dissolved oxygen budget for mathematical modelling purposes as well as the chronic problem of eutrophication. The 1977 study occurred under low flows whereas the summer of 1978 was characterized by higher and more erratic flows, which were a major driving force in terms of water quality behavior. Comparing the 1977 and 1978 ambient N:P ratio data reveals that their rate of spatial decline, or the tendency for nitrogen to rate limit algal biomass production, appears to be a function of the bloom size as measured by chlorophyll a. Chlorophyll a concentrations in the Potomac during 1978 were low in comparison to 1977 observations and had considerably less variability. In September, blue-green algae comprised approximately 80% of the total population, and 87% of the blue-green population was identified as Pseudanabaena catenata. Blue Plains still constitutes, by far, the largest single point source in the Washington Metropolitan area, accounting for 85% of the BOD5, 77% of the TOC, and 58% of the inorganic PO4. (Moore-SRC)
W82-00052

**THE AFTERMATH AT LONGVIEW,**
Water Treatment Plant, Longview, WA.
L. E. Coplen.
Water/Engineering and Management, Vol 128, No 5, p 68-71, May, 1981.

Descriptors: *Volcanoes, *Water pollution effects, *Impaired water use, Disasters, Water treatment facilities, Alum, Costs, Suspended solids, Silt load, Temperature effects, Water supply, Longview, Washington, Mount St. Helens, Debris basins.

The effects of the eruption of Mount St. Helens on the Longview, Washington Water Treatment Plant are detailed. The eruption on May 18, 1980 caused logs and debris to clog the Cowlitz River, which is the plant's source of raw water. By Monday morning, May 19, the river water was steaming hot (90 degrees F) and the turbidity was above 70,000 JTU. The river was carrying millions of cubic yards of volcanic ash, pumice, silt, and wood debris. Water could not be treated at the Longview plant, so reservoir supplies were used, and water was also supplied by the nearby city of Kelso. Columbia River water was diverted to the plant from industrial sources. By Thursday the Cowlitz River water appeared treatable. Because the river water was constantly changing, alum feed rates had to be changed. Additional costs were encountered when sedimentation basins and mixing chambers began to fill once a month rather than once a year. Dredges had to work continuously to clean the river out. Also, additional personnel was required to meet increased operating and maintenance needs. (Small-FRC)
W82-00073

**AN ANALYSIS OF FACTORS AFFECTING OXYGEN DEPLETION IN THE NEW YORK BIGHT,**
Brookhaven National Lab., Upton, NY.
P. G. Falkowski, T. S. Hopkins, and J. J. Walsh.
Journal of Marine Research, Vol 38, No 3, p 479-506, 1980. 14 Fig, 4 Tab, 74 Ref.

Descriptors: *Oxygen, *Aquatic environment, *Organic loading, *Shellfish, Climatology, Carbon, Runoff, Precipitation, Zooplankton, Seasonal variation, Oxygen demand, Coastal waters, Hydrologic data, Water pollution effects, Climate, *Oxygen depletion, *New York Bight.

Historical data extending back to 1910 was analyzed in an attempt to distinguish between man-induced and natural causes of oxygen depletion in the New York Bight. Oxygen depletion is a common feature of areas of restricted flows. A causal chain of events led to the anoxic conditions observed in 1976. A warm winter with large runoff, a low frequency of spring storm events, a deep summer thermocline, persistent southerly winds with few reversals, a large autochthonous carbon load, and low grazing pressure all contributed to anoxia. Calculations suggest that anoxia could have occurred off the New Jersey coast in 1976 without any carbon loading from New York City, and that anoxia in this open shelf system can result from natural physical forcing and biological responses. (Titus-FRC)
W82-00106

**AN AQUATIC RESPIROMETER FOR USE IN SUBLETHAL STUDIES,**
Environmental Sciences Ltd., Vancouver (British Columbia).
W. S. Duval, R. P. Fink, and G. H. Geen.
Water Research, Vol 15, No 7, p 817-822, July, 1981. 4 Fig.

Descriptors: *Respiration, *Aquatic life, *Sublethal effects, Toxicity, *Toxins, Organic compounds, Respirometers, Oil, Water pollution effects, Fish, Salmon, Oxygen consumption, Bioindicators.

A computer-controlled respirometer system was developed to measure oxygen consumption of marine and fresh water organisms at regular intervals over a period of several days. It can be used to document physiological responses of aquatic organisms during and following exposure to sublethal concentrations of a toxicant. The apparatus consists of systems to supply seawater and toxicant, 5-liter glass respirometer vessels, a dissolved oxygen measurement system, light and temperature monitoring and control systems, and computer hardware and software. Tests conducted for several days on juvenile coho salmon (Oncorhynchus kisutch) showed that exposure to water containing 12.1 ppm aromatic hydrocarbons from a Prudhoe Bay crude oil fraction caused sharp increases in respiration rate at four hours exposure, followed by a return to normal at eight hours and subsequent depression. (Cassar-FRC)
W82-00122

**RELATIONSHIP BETWEEN BIOTRANSFORMATION AND THE TOXICITY AND FATE OF XENOBIOTIC CHEMICALS IN FISH,**
Medical Coll. of Wisconsin, Milwaukee. Dept. of Pharmacology and Toxicology.
J. J. Lech, and J. R. Bend.
Environmental Health Perspectives, Vol 34, p 115-131, February 1980. 10 Fig, 12 Tab, 75 Ref.

Descriptors: *Biotransformation, *Fish, Aquatic animals, Metabolism, Chemicals, Organic compounds, Water pollution, Polychlorinated biphenyls, Bioaccumulation, Toxicity, *Xenobiotic chemicals.

Some of the more recent developments in the study of the behavior of xenobiotic chemicals in aquatic species are reviewed. Specific examples are used to demonstrate the relationship between biotransformation and the toxicity, persistence and bioaccumulation of xenobiotic chemicals in fish. Many of the biotransformation reactions that have been described for xenobiotic substances in mammals have been demonstrated in fish, both in vivo and in vitro. Several of these reactions occur in fish at rates sufficient to exert significant effects on the toxicity and residue dynamics of selected chemicals. The inhibition of these reactions can lead to increased toxicity and bioaccumulation factors for certain chemicals. Several classes of compounds, including some polychlorinated biphenyls, are only metabolized slowly, and their disposition in fish may not be influenced to any great extent by biotransformation. Metabolites of compounds which are biotransformed rapidly may appear in certain fish tissues; in many instances these are not accounted for by conventional residue analysis methods. Microsomal mixed-function oxidases in several species of fish have been demonstrated to be induced by specific polycyclic aromatic hydrocarbons and by exposure of the fish to crude oil. Induction of these enzymes in fish can result in both qualitative and quantitative differences in the metabolic disposition of xenobiotics to which fish are exposed. (Baker-FRC)
W82-00186

**TRANSFORMATION OF THE MOUSE CLONAL CELL LINE R846-DP8 BY MISSISSIPPI RIVER, RAW, AND FINISHED WATER SAMPLES FROM SOUTHEASTERN LOUISIANA,**
Louisiana State Univ. Medical Center, New Orleans. Dept. of Microbiology.
W. Pelon, T. W. Beasley, and D. E. Lesley.
Environmental Science and Technology, Vol 14, No 6, p 723-726, June, 1980. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Public health, *Water pollution, *Drinking water, River water, *Raw water, Cultures, Human diseases, Mississippi River, Rivers, Carcinogens, Cell cultures, Organic compounds, Mutagens, Water analysis, *Mississippi.

A total of 118 river water, 70 raw water, and 115 finished water samples were collected over an 18-month period in Mississippi. Cultures of the mouse cell line R846-DP8 were exposed to the water samples. Nineteen of the samples (6%) induced morphological transformation of this cell strain. Transformation was noted with 7 (6%) Mississippi River samples, 7 (10%) raw water samples and 5 (4%) finished water samples. Transformations were not observed in less than four weeks of incubation. It is suggested that the small proportion of water samples which induced cell transformation was probably representative of a larger number which could have induced the changes, but were not detected either because of the limitations imposed by the methods employed or because of the criteria used for transformation. It is suggested that additional studies be made in this area, which could present a major public health problem. (Baker-FRC)
W82-00215

**ANAEROBIC METHANE OXIDATION: OCCURRENCE AND ECOLOGY,**
Wisconsin Univ.-Madison. Dept. of Bacteriology.
For primary bibliographic entry see Field 2H.
W82-00218

**ISOLATION, ENUMERATION, AND CHARACTERIZATION OF AEROMONAS FROM POLLUTED WATERS ENCOUNTERED IN DIVING OPERATIONS,**
Maryland Univ., College Park. Dept. of Microbiology.
R. J. Seidler, D. A. Allen, H. Lockman, R. R. Colwell, and S. W. Joseph.
Applied and Environmental Microbiology, Vol 39, No 5, p 1010-1018, May, 1980. 2 Fig, 4 Tab, 33 Ref.

Descriptors: *Rivers, *Aeromonas, Bacteria, *Anacostia River, Sediments, *District of Columbia, Human diseases, Temperature effects, Aeromonas hydrophila, Aeromonas sobria, Water pollution, Seasonal variations, Wastewater, Wastewater outfall.

This study documents the occurrence and seasonal fluctuations of Aeromonas in the Anacostia River in Washington, D. C., where increased incidences of gastroenteritis and wound infections have occurred in personnel undergoing diver training operations throughout the year. The numbers of Aeromonas cells in Anacostia River sediment and water increased during periods of elevated water temperature, to maxima of 400,000 cells per g of sediment and 300 cells per ml of water. Correspondingly, Aeromonas counts dropped 2 to 4 logs as the water temperature decreased to 0 to 0.5 degrees C. Cultures taken by sterile swabs from the ears and face masks of divers after a 30 minute swim yielded bacterial types and numbers similar to those found in the river. The nasal passages of the divers apparently did not become contaminated by swimming, possibly because of the protective effect of the face masks used by the divers. Properties associated with virulence in A. hydrophila and A. sobria strains isolated from the river, sediment, and divers were investigated. Nearly 40% of the strains of both species collected during the study produced cytotoxic activity for mouse Y-1 adrenal cells, as well as elastase. Enterotoxin activity, as detected by the Y-1 assay, was observed in 3% of the strains of A. sobria and in 6% of the A. hydrophila strains. Fluid accumulation in rabbit ileal loops induced by both species of Aeronomas varied greatly among the 17 strains examined.

Fluid accumulation of at least 0.4 ml/cm was correlated with positive cytotoxin- or enterotoxin-like response in the Y-1 tissue culture assay. (Baker-FRC)
W82-00224

**IMPACT OF CONSTRUCTION OF A HYDROELECTRIC PROJECT ON THE WATER QUALITY OF FIVE LAKES IN NOVA SCOTIA,**
Department of the Environment, Halifax (Nova Scotia).
D. M. Kelly, J. K. Underwood, and D. Thirumurthi.
Canadian Journal of Civil Engineering, Vol 7, No 1, p 173-184, 1980. 12 Fig, 3 Tab, 18 Ref.

Descriptors: *Water quality, *Erosion, *Environmental effects, Hydroelectric powerplants, Wreck Cove, *Nova Scotia, Construction, *Reservoir construction, Dam construction, Tunneling, Logging, Forest fires, Road construction, Vegetation effects, Lakes, Baseline studies, Monitoring.

Water quality of five highland lakes was monitored for 2.5 years during the construction of the Wreck Cove hydroelectric project, Nova Scotia, starting in February, 1975. Tunneling, dam construction, reservoir clear-cutting, slashing, burning, and building access roads had a pronounced impact on Surge Lake, and less on the other lakes--Big, Cheticamp, Gisborne, and Long. Ammonia and nitrate-nitrite concentrations in Surge Lake increased 833 and 7300%, respectively, following clear-cutting and initial construction activities; chlorophyll-a decreased by 1825%. Other water quality parameters which increased on the order of 50-450% were turbidity, suspended solids, conductivity, Ca, Mg, Na, K, and total and ortho-P. The following were more extreme in the Surge Lake watershed than in the other watersheds: slopes, intensity and length of construction, clear-cutting and burning, and a forest fire. In addition, soil was more erosive (less clay), and more vegetative cover, including roots, was removed. (Cassar-FRC)
W82-00227

**ARE SIERRA LAKES BECOMING ACID,**
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
G. R. Bradford, A. L. Page, and I. R. Straughan.
California Agriculture, Vol 35, No 5/6, p 6-7, May/June, 1981. 1 Tab.

Descriptors: *Acidic water, *Air pollution, Lakes, Sierra lakes, Hydrogen ion concentration, *Acid rain, Water pollution sources, Sierra Nevada.

Sierra lakes, most of which have little buffering capacity, showed little change in acidity during the last 15 years. Sampling of 170 lakes in 1965 resulted in an average pH of 6.0 (range 4.7 to 7.3). The mean 1980 pH's measured in 114 randomly selected Sierra lakes in July and October were 6.1 and 6.5, respectively. The higher fall pH probably reflects the seasonal effect of increased residence time of the water in the lake and associated buffering by lake sediments. Ten additional lakes where fish kills had occurred had mean pH of 6.6. (Cassar-FRC)
W82-00231

**BEHAVIOR OF TRIFLURALIN IN AQUATIC MODEL ECOSYSTEMS,**
Environmental Protection Agency, Beltsville, MD. Pesticide Degradation Lab.
R. S. Yockim, A. R. Isensee, and E. A. Walker.
Bulletin of Environmental Contamination and Toxicology, Vol 24, No 1, p 134-141, January, 1980. 5 Tab, 4 Ref.

Descriptors: *Ecosystems, *Pesticides, Trifluralin, Model studies, Ecology, Herbicides, Degradation, Fate of pollutants, *Water pollution effects.

The effects of trifluralin on the aquatic ecosystem were investigated in two different model ecosystems. In the first experiment the recirculating static model ecosystem was used. In the second experiment a continuous dosing system was designed to demonstrate the effect of direct application of trifluralin into the ecosystem. In both experiments organisms were sampled 1, 3, 7, 15, and 30 days after the start of the experiment. In the first experiment the amounts of trifluralin available for accumulation by the organisms depended on the rate of desorption from the soil. In the second, the actual water levels obtained were 0.8, 2.5, and 21.6 ppb in the 1, 10, and 100 ppb treatments, respectively, by day 30. The data indicated extensive variation that can be obtained when using different model ecosystem designs in studying the behavior of pesticides in the aquatic ecosystem. These differences were probably related to the rapid metabolism and degradation of soil-incorporated trifluralin in the first experiment and to the continuous input of trifluralin in the second experiment. A very important difference between the two ecosystems was the toxic effect of trifluralin on the algae and fish during the second experiment. It is concluded that the risks of trifluralin in the aquatic ecosystem are greatest when there is a continuous input of trifluralin. With occasional soil-incorporated input, the degradation processes would minimize the risk. (Baker-FRC)
W82-00233

**EFFECT OF ESTUARINE SEDIMENT PH AND OXIDATION-REDUCTION POTENTIAL ON MICROBIAL HYDROCARBON DEGRADATION,**
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
For primary bibliographic entry see Field 2L.
W82-00243

**EFFECTS OF HALOGENATED ORGANIC COMPOUNDS ON PHOTOSYNTHESIS IN ESTUARINE PHYTOPLANKTON,**
Environmental Protection Agency, Gulf Breeze, FL. Gulf Breeze Environmental Research Lab.; and Environmental Research Lab., Johns Island, SC. Bears Fluff Field Station.
S. J. Erickson, and C. E. Hawkins.
Bulletin of Environmental Contamination and Toxicology, Vol 24, No 6, p 910-915, 1980. 6 Tab, 13 Ref.

Descriptors: *Estuarine environment, *Phytoplankton, *Chlorinated hydrocarbons, Toxicity, Water pollution effects, *Organic compounds, Cooling water, Photosynthesis, Wastewater treatment, Chlorination, Pentachlorophenol, Pentabromophenol, Phenols.

The effects of 15 organic compounds on photosynthesis in native estuarine phytoplankton were studied in outdoor aquaria. Some of the compounds tested are formed by chlorine biocides in cooling waters. Chloroform, bromoform, ethylene bromide, phenol, 4-bromophenol, and 2,4,6-trichlorophenol at concentrations up to 2.0 mg per liter did not affect C14 uptake by phytoplankton. Trichloroethylene stimulated C14 uptake at 0.5 to 1.0 mg per liter. Tetrachloroethylene inhibited uptake slightly at 2.0 mg per liter. C14 uptake expressed as % of control for concentrations of 0.5 to 2.0 mg per liter of other organic compounds were as follows: 2,4,6-tribromoanisole, 81-76%; 4-chlorophenol, 97-94%; 2,4,6-tribromophenol, 96-89%; pentachlorophenol, 39-2%; and pentabromophenol, 4 to -1%. Further tests with the two most toxic compounds, pentabromophenol and pentachlorophenol, at concentrations of 0.125 to 2.0 mg per liter showed that mixed phytoplankton were more sensitive to the chemicals than four individual phytoplankton cultures. Haloamines produced by metering NaOCl and NH4Cl into the aquaria were more inhibitory than either chemical separately. Chloramine T was not inhibitory to photosynthesis. (Cassar-FRC)
W82-00266

**LETHALITY OF A SUSPENDED CLAY TO A DIVERSE SELECTION OF MARINE AND ESTUARINE MACROFAUNA,**
Army Engineer Waterways Experiment Station, Vicksburg, MS.
V. A. McFarland, and R. K. Peddicord.
Archives of Environmental Contamination and Toxicology, Vol 9, No 6, p 733-741, 1980. 4 Fig, 3 Tab, 21 Ref.

Descriptors: *Suspended solids, *Kaolinite, Water pollution effects, Suspended load, Silicates, Clay minerals, Invertebrates, Pollutants, Laboratory studies, *Estuaries, *Fauna, Macrofauna, Estuarine environment.

The impact of suspensions of processed kaolinite, a common sheet-silicate clay mineral, on marine and estuarine macrofauna was investigated. The use of kaolinite permitted a study of the lethal effect of suspended particles themselves rather than the combined physical and chemical effects of sediments in various conditions of contamination. The flow-through system of 16 hemispherical 75-L aquaria supplied with kaolin and dilution water at estuarine or oceanic salinity was employed. A wide range of sensitivities was noted. Blue mussels measuring 2.5 cm in length reached 10% mortality after five days. The tunicate Ascidia ceratodes was the most sensitive species tested. In none of the tests could the LC50 value be calculated from the LC20 or LC10 values. There may have been a correlation between normal habitat of the species and sensitivity to suspended kaolin, although no phylogenetic correlations were apparent. No species that restricted itself to soft muddy bottoms was sensitive. All those species that were sensitive to high kaolin concentrations were either invertebrates occurring predominantly on sandy bottoms or in fouling communities, or fish not intimately associated with the bottom. (Baker-FRC)
W82-00268

**EVALUATION OF METHODOLOGIES FOR THE DETERMINATION OF ACUTE TOXICITY IN PULP AND PAPER EFFLUENTS,**
Institute of Paper Chemistry, Appleton, WI.
For primary bibliographic entry see Field 5A.
W82-00297

**PRIORITIZATION OF CHEMICALS ACCORDING TO THE DEGREE OF HAZARD IN THE AQUATIC ENVIRONMENT,**
Dow Chemical Co., Midland, MI.
D. R. Branson.
Environmental Health Perspectives, Vol 34, p 133-138, February 1980. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Water pollution, *Priorities, Hazards, Assessments, Decision making, Planning, Regulations, Standards, Chemical analysis, *Water pollution effects.

As an alternative to arbitrarily listing or delisting chemicals for the purpose of priority control, this paper suggests a promising scientific approach to selecting priority chemicals based on the principles of hazard assessment for chemicals in the aquatic environment. According to the hypothesis employed, the highest priority chemicals are those with the smallest margin of safety, defined as the gap between the no-observable-effect concentrations and the ambient exposure concentrations. The no-observable-effect concentrations are based on the results of chronic or sensitive life stage tests with aquatic organisms and the acceptable daily intake rate for fish eaters. The ambient exposure concentrations are levels either measured in fish and water, or roughly estimated from a simple nomogram that requires only two of the following three factors: environmental release rate, ratio of dissipation to bioconcentration potential, or ambient residues in fish. The chemicals studied to illustrate this approach to prioritizing chemicals are: polychlorinated biphenyls, di-2-ethylhexyl phthalate, linear alkylbenzene sulfonate, and pentachlorophenol. (Baker-FRC)
W82-00300

**THE SIGNIFICANCE OF THE SUBMARINE GEOLOGY OF UPPER SPENCER GULF, SOUTH AUSTRALIA, TO ENVIRONMENTAL DECISION-MAKING,**
Adelaide Univ. (Australia). Dept. of Geology.
For primary bibliographic entry see Field 2L.
W82-00314

**PROJECTED TILE EFFLUENT EFFECTS ON THE OLDMAN RIVER,**

Department of Agriculture, Lethbridge (Alberta). Irrigation Div.
D. B. Harker.
Canadian Water Resources Journal, Vol 6, No 2, p 65-75, 1981. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Water quality, *Tile drainage, Rivers, Oldman River, River flow, Flow, *Effluents, *Alberta.

Possible negative effects that tile effluent might have on the water quality of receiving systems such as the Oldman River were evaluated. The Irrigation Division of Alberta Agriculture conducted a program for three years, 1977-1979, to monitor effluent discharge and chemistries from 20 tile drainage sites. Projections were made concerning the possible effect of tile effluent on the water quality. Extremes in both tile and river flows were considered. Under conditions of average river flow, tile effluent is expected to have a minimal impact on river water quality in the near future. However, during periods of low river flow, future high tile discharges might substantially degrade water quality. The recent government announcement of an intent to build a regulating dam on the Oldman River within ten years may negate low flow conditions. Another alternative would be to direct drainage waters to large evaportion basins such as are presently under use or consideration in the Western United States. These basins have the disadvantage of needing high evaporation rates proportional to the storage area required. At present, much of the receiving water carrying tile effluent within Alberta contains high quality irrigation return flow, water that should be returned to the river. Another alternative could be to dilute saline river waters via interbasin transfer from a purer system. (Baker-FRC)
W82-00333

## DEVELOPMENT OF BIOASSAY PROCEDURES FOR DEFINING POLLUTION OF HARBOR SEDIMENTS,

Wisconsin Univ.-Superior.
D. A. Bahnick, W. A. Swenson, T. P. Markee, D. J. Call, and C. A. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-178261, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-81-025, June 1981. 4 p.

Descriptors: *Bioassay, *Toxicity, *Sediments, *Water pollution sources, *Dredging, *Aquatic life, Interstitial water, Invertebrates, Aquatic animals, Metals, Polychlorinated biphenyls, DDE, Sunfish.

Reliable, cost effective procedures for identifying the potential effects of sediment chemical contaminants on water quality and aquatic communities are needed because of the continuous dredging of large volumes of sediments by the Corps of Engineers. Procedures studied include 96-hr toxicity tests employing Hexagenia limbata, Daphnia magna and Pontoporea affinis as biological probes, monitoring cough frequencies of bluegill sunfish in interstitial water derived from sediments, chemical analysis of sediment-water systems, and chemical analysis of chironomids and H. limbata exposed to the sediments. Sediment-water systems caused little toxicity in 96-hr exposure tests, although Daphnia was the most sensitive of these animals to toxicants. Similar cough frequencies were found for bluegill sunfish in dechlorinated city water compared to sediment interstitial water-Lake Superior water mixtures but it was observed that broken operculer patterns occurred in the interstitial water-Lake Superior Water mixtures. Most of the sediments used in the bioassay tests would be considered polluted according to at least one chemical parameter. Studies on extracting chemical species from the sediments showed that only small amounts could be readily extracted with Lake Superior Water. Evidence was found that chironomids dwelling in harbor sediments bioaccumulated PCBs and p,p'-DDE and possibly some metals. (Moore-SRC)
W82-00387

## NATURAL VARIATION IN ABUNDANCE OF SALMONID POPULATIONS IN STREAMS AND ITS IMPLICATIONS FOR DESIGN OF IMPACT STUDIES,

Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
J. D. Hall, and N. J. Knight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198954, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-81-021, July 1981. 4 p, 1 Tab.

Descriptors: *Fish populations, *Water pollution effects, *Nonpoint pollution sources, *Salmon, Aquatic habitats, Environmental effects, Stream fisheries, Stream degradation, Ecosystems.

Salmonids are the principal fish species of economic importance affected by pollution in the Western United States. Assessment of damage to these fish populations cannot be undertaken without some understanding of the natural variation in abundance within and between populations. An extensive literature review relating to stock size and production of salmonid populations in streams was carried out to bring together data on the magnitude of natural variation in population size and to relate this variability to environmental conditions whenever possible. Temporal and spatial variation may be as high as several orders of magnitude, and are sufficient to mask significant perturbations caused by nonpoint source (NPS) pollutants. Environmental variables most closely associated with spatial variation are those relating to the quality of salmonid habitat, particularly physical characteristics such as cover. Streamflow and food abundance have been associated with both temporal and spatial variation. Considerable emphasis should be placed upon systems of rating habitat quality in attempts to minimize the effects of natural variation when evaluating the impact of NPS pollutants. As a means of more clearly separating natural variation from damage caused by NPS pollutants, more emphasis should be placed upon the study of basic processes in stream ecosystems and more extensive use should be made of paired comparisons in the design of impact studies. (Moore-SRC)
W82-00389

## LONGITUDINAL SUCCESSION IN IMPACT ASSESSMENT OF RIVER SYSTEM FISH COMMUNITIES,

Argonne National Lab., IL.
R. M. Goldstein.
Water Resources Bulletin, Vol 17, No 1, p 75-81, February, 1981. 5 Fig, 2 Tab, 29 Ref. OWRT-A-052-CONN(21).

Descriptors: *Fish populations, *Environmental effects, *Rivers, Speciation, Longitudinal succession, Ecology, Aquatic habitats, Habitats, *Water pollution effects.

Longitudinal succession indicates an increase in diversity and species richness of fish communities with increasing river size. This is a result of increasing habitat complexity and environmental stability. Cultural impacts (agriculture, dam construction, pollution, introduced species) decrease the diversity, species richness, and evenness. Fish communities in 14 Connecticut and Rhode Island rivers were surveyed during the summer of 1974. Data was normalized to eliminate the bias caused by linear succession and compared with non-normalized data using regression analysis. The two sets of data were similar. Evenness, which is not affected by longitudinal succession, was the most sensitive parameter. Introduced species, such as centrarchids, cause errors because many increase in number with altered physical habitat. Ideally, impact should be evaluated with the original community as a baseline. In most cases, however, this information is unavailable. (Cassar-FRC)
W82-00399

## EFFECTS OF SURFACE MINING ON WATER QUALITY IN A SMALL WATERSHED, SULLIVAN COUNTY, INDIANA,

Geological Survey, Indianapolis, IN. Water Resources Div.
J. G. Peters.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $8.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-543, June 1981. 61 p, 12 Fig, 15 Tab, 50 Ref.

Descriptors: *Water quality, *Coal mining, *Water pollution effects, *Acid mine drainage, Small watersheds, Geology, Strip mines, Hydrogen ion concentration, Dissolved solids, Alkalinity, Cation exchange, Heavy metals, Suspended solids, Sediment transport, Settling basins, Chemical stratification, Thermal stratification, Profiles, Algae, *Indiana, Sullivan County, Spencer Creek, South Lake.

The water quality in an unnamed tributary to Spencer Creek upstream and downstream from a surface mine and in South Lake adjacent to the mine were monitored during a 5-year study (1975-79) in the 1,210-acre watershed of the tributary. Compared with the background values, pH and concentrations of all major dissolved ions and dissolved, suspended, and streambed metals generally increased in Spencer Creek tributary downstream from the mine. Median dissolved-sodium and sulfate concentrations increased as much as eighteenfold and fourteenfold, respectively, and median dissolved-manganese and suspended aluminum concentrations increased as much as sevenfold and more than twofold. Concentrations of suspended metals decreased more than 50% after installation of sediment ponds by the mine operator. During high streamflow, concentrations of major ions at background and at mined sites on Spencer Creek tributary decreased, but dissolved- and suspended-metal concentrations increased downstream from the mine. South Lake exhibited seasonal stratification and mixing characteristics of other lakes at a similar latitude. However, the bottom 3 feet of the water column demonstrated persistent chemical stratification. Phytoplankton populations of the lake varied seasonally, and the population density patterns resembled those in other lakes at latitudes similar to that of South Lake. (USGS)
W82-00427

## CLINICAL TESTS IN AQUATIC TOXICOLOGY: STATE OF THE ART,

Columbia National Fisheries Research Lab., MO.
For primary bibliographic entry see Field 5A.
W82-00464

## CHLORINATED DRINKING WATER,

For primary bibliographic entry see Field 5F.
W82-00467

## FIELD EXPERIMENTS ON RESPONSES OF A FRESHWATER, BENTHIC MACROINVERTEBRATE COMMUNITY TO VERTEBRATE PREDATORS,

Savannah River Ecology Lab., Aiken, SC.
J. H. Thorp, and E. A. Bergey.
Ecology, Vol 62, No 2, p 365-375, April, 1981. 6 Fig, 1 Tab, 31 Ref.

Descriptors: *Benthos, *Thermal stress, *Nuclear reactors, Nuclear powerplants, Powerplants, Temperature effects, Thermal water, Heated water, *Water pollution effects, *Thermal pollution, Waste heat.

Possible effects of thermal effluents from a nuclear production reactor and other environmental characteristics such as season and plot locality on predator-prey interactions were examined in the littoral zone of a soft-bottom reservoir near Aiken, South Carolina. Thirty-six predator (fish and turtle) exclusion cases were placed in shallow water at six locations along a thermal gradient in Par Pond, a 1100-ha cooling reservoir on the Savannah River Plant. Cages were in place during three, 3-mo test periods beginning in September of 1977. Relations between predator treatment and community response, such as changes in density and taxon richness, were generally unaffected by plot locality, temperature fluctuations from thermal effluent, or seasonal changes. When data from caged and control plots were pooled, however, both location and water temperature individually had direct impacts on the benthic community. (Baker-FRC)
W82-00477

**TADPOLES AS INDICATORS OF HARMFUL LEVELS OF POLLUTION IN THE FIELD,**
Nature Conservancy, Abbotts Ripton (England). Monks Wood Experimental Station.
For primary bibliographic entry see Field 5A.
W82-00478

**UNDERSTANDING ACID RAIN,**
For primary bibliographic entry see Field 5B.
W82-00479

**TOXICITY AND ECOLOGICAL SIGNIFICANCE OF TRACE ELEMENTS IN AQUATIC ENVIRONMENTS,**
Tennessee Univ., Knoxville.
For primary bibliographic entry see Field 5B.
W82-00498

## 5D. Waste Treatment Processes

**WATER-RELATED ENVIRONMENTAL CONTROL REQUIREMENTS AT MUNICIPAL SOLID WASTE-TO-ENERGY CONVERSION FACILITIES,**
Iowa State Univ., Ames.
J. C. Young, and L. D. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0116, Price codes: A10 in paper copy, A01 in microfiche. Dept. of Energy Report DOE/EV-0116, Sept, 1980. 208 p, 62 Fig, 33 Tab, 46 Ref, Append.

Descriptors: *Waste disposal, *Municipal wastes, *Wastewater treatment, *Water use, Water conservation, Land disposal, Solid wastes, Fuel, Water pollution control, Cost analysis, Energy sources, Recycling, Water reuse.

A study was initiated to evaluate water use and wastewater production at municipal solid waste-to-energy conversion systems, to identify water pollution control technology requirements, and to identify water-related limitations to their design and commercialization. In many designs, water use can be reduced considerably and production of wastewaters often can be eliminated by using water for multiple purposes within a facility. Wastewater associated with waste processing and storage at mass-burning and at dry-process refuse-derived fuel (rdf) facilities usually are produced infrequently and in small quantities, or are essentially uncontaminated. The major point of wastewater production is associated with ash quenching or sluicing and disposal in landfills or ashponds. All water-related environmental concerns associated with these facilities can be satisfied by using available wastewater treatment technology, improved water use management and accepted landfilling practices. Developers of the wet-pulping process have stated that there will be no wastewater discharge from the processing facilities. Wastewaters produced by pyrolysis create the greatest potential for causing adverse environmental impacts because of their high organic content and the type of organic materials present. While satisfactory wastewater treatment can be accomplished, the associated costs may impact heavily upon commercial viability. (Moore-SRC)
W82-00037

**ABSORPTION OF RADIUM AND THORIUM FROM NEW MEXICO URANIUM MILL TAILING SOLUTIONS,**
Bureau of Mines, Salt Lake City, UT. Salt Lake City Research Center.
H. R. Beard, H. B. Salisbury, and M. B. Shirts.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147431, Price codes: A02 in paper copy, A01 in microfiche. Report of Investigations 8463, 1980. 17 p, 1 Fig, 5 Tab, 8 Ref, Append.

Descriptors: *Radium, *Thorium, *Radioactive waste disposal, *Mine wastes, *Absorption, Wastewater treatment, Industrial wastes, Uranium, Desorption.

When uranium ore is processed, up to 5% of the radium is taken into solution. Most of this soluble radium passes through the uranium recovery operations to the tailing disposal system. Although the actual weight of radium and other soluble radionuclides is very small, the concentrations in the tailing pond solutions generally are far above the permissible levels. Tailing and soil samples from New Mexico were evaluated for their potential to absorb radium and thorium from tailing liquors. Absorption ranged from 0 to 97% from radium and 0 to 60% from thorium. Essentially all of the New Mexico samples absorbed some radium from the tailing solutions, but the thorium absorption was nil in most cases. Batch desorption tests using relatively dilute ammonium and sodium salt solutions showed desorptions ranging from essentially 0 to 75%. Soils, clays, and other materials can absorb large amounts of radium from uranium tailing solutions, but it has not been possible to relate the absorption to specific chemical or physical characteristics. An alpha spectrometric method was used to determine the radium and thorium concentrations in the solutions and solids. (Moore-SRC)
W82-00040

**DEWATERING OF INDUSTRIAL CLAY WASTES,**
Bureau of Mines, University, AL. Tuscaloosa Research Center.
A. G. Smelley, B. J. Scheiner, and J. R. Zatko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-179954, Price codes: A02 in paper copy, A01 in microfiche. Bureau of Mines Report of Investigations 8498, 1980. 15 p, 3 Fig, 11 Tab, 6 Ref.

Descriptors: *Clays, *Industrial wastes, *Dewatering, *Flocculation, Wastewater treatment, Polymers, Solids, Slurries, Coal, Potash, Phosphates, Uranium, Talc, Titanium.

As a part of research conducted in its mission to effect pollution abatement, the Bureau of Mines is developing a dewatering technique that allows for disposal of clay wastes, for reuse of water now lost with clays, and for reclamation of mined land. The technique utilizes a high-molecular-weight nonionic polyethylene oxide polymer (PEO) that has the ability to flocculate and dewater materials containing clay wastes. In laboratory experiments, coal-clay waste, potash-clay brine slurry, phosphatic clay waste, uranium tailings, and talc tailings were successfully consolidated. Coal-clay waste was consolidated from 3.6 to 57% solids; potash-clay brine slurry was consolidated from 3.8 to 35%; phosphatic clay waste from 15.6 to 49%; uranium tailings from 15.4 to 67%; tailings from talc production from 9.7 to 53%; and an acidic titanium dioxide slurry from 1.68 to 30%. In most cases PEO with a molecular weight of 8 million was superior to a 5 million molecular weight polymer. (Brambley-SRC)
W82-00041

**TREATMENT OF FLORIDA SURFACE WATERS FOR USE IN PHOSPHATE BENEFICIATION,**
Bureau of Mines, University, AL. Tuscaloosa Research Center.
D. A. Stanley, B. J. Scheiner, and P. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-232407, Price codes: A02 in paper copy, A01 in microfiche. Bureau of Mines Report of Investigations 8535, 1981. 13 p, 3 Fig, 3 Tab, 8 Ref.

Descriptors: *Organic matter, *Surface water, *Industrial water, *Wastewater treatment, Flocculation, Filtration, Water quality, Impaired water use, Phosphates, *Phosphate mining, *Recycling, Water reuse, Florida.

In response to competition for water by other users, the phosphate mining industry has reduced its total water use by recycling, but lost water is generally replaced by deep well pumping from the Floridian aquifer. A potential alternative source of supply is surface water; however, humic products in central Florida surface waters interfere with the flotation beneficiation process. Laboratory-scale experiments were conducted to determine whether or not surface waters with a high organic content could be purified sufficiently to be used to replace the high-quality deep well water. Water samples were obtained from Oak Creek and Horse Creek located in Polk County. The color of the waters was 300 Pt-Co units. The water samples were flocculated with a cationic polyethylenimine polymer, and processed in a sand filter. This treatment removed most of the organic materials from the water. Untreated surface water, treated surface water, and distilled water were used to compare the flotation response of the acid insolubles in an amine flotation circuit. Surface water treated with PEI-1000 was shown to be as effective as distilled water for the acid-insoluble-flotation step. Flocculation and filtration can therefore produce water suitable for amine flotation of quartz, which would permit substitution of surface water for deep well water. (Moore-SRC)
W82-00048

**DEWATERING FLORIDA PHOSPHATIC CLAY WASTES WITH MOVING SCREENS,**
Bureau of Mines, University, AL. Tuscaloosa Research Center.
L. W. Brandt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-104373, Price codes: A02 in paper copy, A01 in microfiche. Bureau of Mines Report of Investigations 8529, 1981. 19 p, 8 Fig, 4 Tab, 8 Ref.

Descriptors: *Dewatering, *Clays, *Industrial wastewater, *Mineral industry, Gels, Sedimentation, Slurries, Wastewater treatment, Attapulgite, Phosphates, Phosphate mining, Florida.

Phosphatic clay wastes from beneficiation plants are stored in large dammed areas to allow natural settling. Because they are colloidal suspensions, these wastes settle very slowly, only to about 20% solids in many years. A novel technique to effectively dewater phosphatic clay wastes was developed. The solids contained in the clay waste slurry are slowly compressed by moving wire mesh screens through the system. Slow compression rates gave best results, and the mesh size of the screen used was of secondary importance to the rate of compression. It is believed that the moving screens distort the gel structure of the phosphatic clay system and cause the release of water. Samples of 18 clay wastes, including a high-grade attapulgite from beneficiation plants of the Florida phosphate field, were studied using the method. Typical samples were concentrated from initial solids of 4.7 and 11.9% to 16.8 and 25.2%, respectively, in 3 1/2 days. The high-grade attapulgite sample was dewatered from 2.7% solids to 13% solids in the same period. In general, clay wastes with poor natural settling behavior give higher final solids by moving screen compaction than those that are better natural settlers. The work demonstrated that a different mechanism was operating in compaction than in natural settling because the high attapulgite samples responded well to screen compaction. (Moore-SRC)
W82-00049

**PROCESS FOR THE REMOVAL OF INORGANIC SALTS FROM A WATER STREAM,**
For primary bibliographic entry see Field 5F.
W82-00055

**LAND RESTORATION FOLLOWING OIL-WELL DRILLING,**
V. L. Dover, Jr.
U.S. Patent No. 4,234,421, 7 p, 1 Fig, 7 Tab, 11 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 1106, November 18, 1980.

Descriptors: *Patents, *Waste treatment, *Separation techniques, Chemical reactions, Water pollution sources, Waste disposal, *Land reclamation, *Oil fields, *Drilling fluids, Water reuse, Energy conservation, Water recovery, Drill cuttings.

An admixture of waste (oil-well) drill cuttings, drilling fluid and by-products of rotary drilling are separated into good-quality water and high-density

solids by chemical and mechanical means in original earthen-mud storage and/or reserve pits. The treatment produces two useful benefits: (1) good-quality water (useful for agriculture or for drilling a new well) is recovered, and (2) resulting concentrated solids are of such a high density that the land area occupied by and containing such dewatered solids can be immediately leveled and restored to the same use it had before the well was drilled. The effect is a reduction in energy over the present method of hauling whole mud off by trucks to a commercial waste-disposal site. When environmental considerations do not require restoration of the site and reserve pits are allowed to weather to a point of collapse, this process reduces or eliminates surface pollution of nearby creeks, rivers and ponds by preventing release of drilling-fluid chemicals. It also effects a net reduction in energy by breaking the pollution chains. (Sinha-OEIS)
W82-00057

**PROCESS FOR REMOVAL OF MERCURY AND MERCURY COMPOUNDS FROM AQUEOUS SOLUTIONS AND INDUSTRIAL WASTE LIQUORS,**
Wacker-Chemie G.m.b.H., Munich (Germany, F. R.). (Assignee).
E. Falbesaner, J. Bichler, and E. Wimmer.
U.S. Patent No. 4,234,422, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 1106, November 18, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, *Separation techniques, *Industrial wastes, Filtration, *Mercury, Sands, Filters, Mercury removal, Backwashing.

A process removes mercury and mercury compounds from aqueous solutions and, in particular, industrial waste waters, by reduction and filtration. After reduction, the waters are cleared by letting the mercury particles and dirt particles flow into a settling basin. Subsequently, the supernatant aqueous solution from the settling basin is subjected to filtration in a deep filter with a filtering agent having a grain size of 0.02 mm to 2 mm and preferably 0.04 mm to 0.6 mm, whereupon the mercury is returned by reverse rinsing the settling basin from the filter and is separated in the settling basin. (Sinha-OEIS)
W82-00058

**ENERGY RECOVERY SYSTEM,**
Department of Energy, Washington, DC. (Assignee).
A. S. Moore, and F. H. Verhoff.
U.S. Patent No 4,234,423, 6 p, 1 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 1106, November 18, 1980.

Descriptors: *Patents, *Wastewater treatment, Industrial wastes, Pollutants, Organic wastes, Oxidation, *Chemical oxygen demand, Scrubbers, *Coal gasification plants, Wet air oxidation.

The invention is directed to an improved wet air oxidation system and method for reducing the chemical oxygen demand (COD) of waste water used from scrubbers of coal gasification plants, with this COD reduction being sufficient to effectively eliminate waste water as an environmental pollutant. The improvement of the invention is provided by heating the air used in the oxidation process to a temperature substantially equal to the temperature in the oxidation reactor before compressing or pressurizing the air. The compression of the already hot air further heats the air which is then passed in heat exchange with gaseous products of the oxidation reaction for 'superheating' the gaseous products prior to its use in turbines as the driving fluid. The superheating of the gaseous products significantly minimizes condensation of gaseous products in the turbine so as to provide a substantially greater recovery of mechanical energy from the process. (Sinha-OEIS)
W82-00059

**APPARATUS FOR THE PURIFICATION OF OILY EMULSIONS, SOLUTIONS, AND INDUSTRIAL WASTE WATERS,**
R. F. Piepho.
U.S. Patent No. 4,234,424, 9 p, 5 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 1107, November 18, 1980.

Descriptors: *Patents, *Wastewater treatment, *Industrial wastes, *Separation techniques, *Oily water, Chemical reactions, Filtration, Filters, Equipment, Oil industry.

The invention relates to an apparatus for the purification of oily emulsions, solutions, industrial waste waters or the like. The apparatus includes a reaction container, at least one discharge connecting piece, an inflow trough and a band filter fitted with a fleece band, a filtrate container arranged under it and a sludge container provided at the discharge end of the band filter. The process for purification by chemical separation includes collecting the oily waste waters, adding a demulsifier if the oil content exceeds 2% and separating, or draining, the oil which floats to the surface. A powdered separating reagent may be mixed into the emulsion with adsorption occurring in a very short period of time. The apparatus can be transported to the site where the contaminated waste waters occur. A further object is to increase overall performance in waste water treatment by providing an apparatus with two treatment chambers so that one may operate while the second is being filled and by also providing that the sludge produced by the apparatus has an elongated drying path. (Sinha-OEIS)
W82-00060

**PRESSURIZED OXYGENATION SYSTEM AND METHOD,**
FMC Corp., San Jose, CA. (Assignee).
C. C. Pearson.
U.S. Patent No. 4,235,719, 9 p, 2 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 4, p 1532-1533, November 25, 1980.

Descriptors: *Patents, *Wastewater treatment, Sewage treatment, *Oxygenation, Oxygen, Pressure, Equipment.

A system for performing an oxygenation process within a body of sewage at atmospheric pressure includes an oxygen absorber coupled to an oxygen supply at superatmospheric pressure. A storage vessel has an elongate chamber which is oriented vertically in the system. Pipes and valves are coupled to the upper and lower ends of the chamber so that the chamber is alternately connected with the oxygen absorber and the body of sewage, thereby providing alternate high pressure and low pressure half cycles respectively. Initially, oxygenated liquor at superatmospheric pressure is in the oxygen absorber and the elongated chamber is filled with a quantity of oxygen content liquor at atmospheric pressure. The valves are then operated during the high pressure half cycle to admit oxygenated liquor into the elongate chamber through the lower end and to simultaneously expel liquor and undissolved oxygen from the upper end into the oxygen absorber. The valves are then operated during the low pressure half cycle to reduce the chamber pressure to atmospheric and to admit a quantity of liquor from the body of sewage into the elongate chamber through the top end while simulataneously expelling the oxygenated liquor from the bottom end into the body of sewage. Thus, oxygen which comes out of solution and collected as relatively large bubbles as the pressure in the chamber is reduced to atmospheric pressure, will be retained in the elongate chamber and returned to the oxygen absorber during the next high pressure half cycle. (Sinha-OEIS)
W82-00064

**UNDERWATER AERATOR,**
Hanshin Engineering Co. Ltd., Osaka (Japan). (Assignee).
R. Nakajima, Y. Takei, S. Kawauchi, and T. Fujita.
U.S. Patent No. 4,235,720, 6 p, 4 Fig, 15 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 4, p 1533, November 25, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, *Aeration, Equipment, Circulation, Bubbles, Underwater.

An aerator comprises an air diffuser rotor for receiving air and forcing out the air through small perforations formed in its peripheral wall, and an agitator-pump unit placed immediately above the rotor. When the aerator is installed on the bottom of a waste water purifying tank, the agitator-pump unit raises water from the bottom of the tank and produces a circulating flow of water through the interior of the tank, while the air diffuser rotor forces out air bubbles into the circulating flow, whereby an improved areation efficiency can be achieved. (Sinha-OEIS)
W82-00065

**HIGH CAPACITY WASTE WATER TREATMENT SYSTEM,**
Bauer Bros. Co., Springfield, OH. (Assignee).
M. E. Ginaven.
U.S. Patent No. 4,235,724, 8 p, 5 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 4, p 1534, November 25, 1980.

Descriptors: *Patents, *Wastewater treatment, *Sewage treatment, *Separation techniques, Flow, Flow control, Screens, Storm water, Quiescent flow.

A system for treatment of waste water received from a sewer system comprises one or more lines of static inclined screen each of which lines is served by a single low lying infeed duct or conduit connected to receive waste water which is discharged from the associated sewage system. Each infeed duct includes longitudinally spaced outlets directed upwardly and vertically to provide a like delivery of waste water embodying solids to each of the screens. Each infeed duct is so designed and interrelated with the line of screen which it serves that each of the screens in the lines is provided with equal volumetric non-turbulent, quiescent flow which is ideal for separating purposes. This is achieved by stepping the cross-sectional area of the infeed duct to achieve a uniform flow velocity at each of its outlets. The system is capable of handling a high volume of turbulent waste water such as is found in a sewage systems infiltrated with large volumes of water due to heavy rains and/or flooding conditions. (Sinha-OEIS)
W82-00066

**APPARATUSES FOR THE ANAEROBIC DIGESTION OF NATURAL ORGANIC WASTE,**
Hamworthy Engineering Ltd., Fleets Corner (England). (Assignee).
D. L. Hawkes, R. Horton, and D. A. Stafford.
U.S. Patent No. 4,233,155, 6 p, 3 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 2, p 687, November 11, 1980.

Descriptors: *Patents, *Wastewater treatment, *Organic wastes, Sewage treatment, *Anaerobic digestion, Anaerobic conditions, Separation techniques, Equipment.

An apparatus for the anaerobic digestion of natural organic waste comprises a feed tank, a digester and an outlet tank. There is further provided feed means which feeds waste from the feed tank to the digester at an adjustable continuous rate. A gas pump may be used to recirculate from the top of the digester through a diffuser to the bottom of the digester. A suitable gas pump comprises a container partially filled with liquid so there is a space above the liquid surface and within the container sealed by the liquid from the exterior of the container. The pump is placed in the space. (Sinha-OEIS)
W82-00069

**THE HORSE CREEK BASIN PROJECT,**
Davis and Floyd Engineers, Inc., Greenwood, SC.
For primary bibliographic entry see Field 5G.
W82-00071

**FACULTATIVE LAGOON EFFLUENT POLISHING USING PHASE ISOLATION PONDS,**

Environmental Protection Systems, Inc., Jackson, MS.
E. C. McGriff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-205965, Price codes: A08 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-084, July 1981, 3 p, 1 Fig.

Descriptors: *Wastewater lagoons, *Wastewater treatment, *Phase isolation ponds, Effluents, Biochemical oxygen demand, Municipal wastewater, Rainfall, Algae, Suspended solids, *Clinton, *Mississippi.

The performance of phase isolation lagoons was investigated at Clinton, Mississippi, from May 1978 to May 1979. The study system consisted of two facultative lagoons arranged in series followed by two isolation ponds used alternately for final polishing. The isolation ponds were operated on a fill and draw basis with isolation periods varying from 20 to 44 days. It appears that the phase isolation process can, at times, produce an effluent that will meet the National Pollutant Discharge Elimination System (NPDES) limitations for Clinton. However, the process is not consistent in its performance and should not be considered as a final process unit. A significant correlation between the area rainfall and effluent BOD5 and TSS indicates sensitivity of the process to climatic and seasonal conditions. A correlation matrix showed a relationship between the effluent suspended solids, and in situ secchi depth, suspended solids, nitrate nitrogen, and total phosphorus. Microscopic examinations revealed that Chlorella appeared most often in both isolation ponds, with Oscillatoria, Ankistrodesmus, Pediastrum, and Ulothrix dominating to a lesser degree. (Moore-SRC)
W82-00092

**WASTEWATER TREATMENT BY ROOTED AQUATIC PLANTS IN SAND AND GRAVEL TRENCHES,**
Moulton Niguel Water District, Laguna Niguel, CA.
P. R. Pope.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-213241, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-091, July 1981. 6 p, 3 Fig, 2 Tab.

Descriptors: *Biological wastewater treatment, *Aquatic plants, *Raw wastewater, *Municipal wastewater, Wastewater treatment, Nitrogen removal, Phosphorus removal, Laguna, *California.

A patented process developed by the Max Planck Institute (MPI) of West Germany to treat industrial wastes was evaluated as an energy-efficient method to treat municipal wastewater. The major goal was to achieve effluents meeting the Federal Effluent Standards using this novel biological treatment process that requires a minimal amount of mechanical equipment and manpower for normal operation. The Moulton Niguel Water District of Laguna, California, constructed and operated an earthen trench system using rooted aquatic plants for the treatment of wastewater. Two trenches in series were planted with the reed Phragmites and the bulrush Scirpus, respectively. A 2-month study using conventional secondary effluent as the trench influent showed the system was not effective for removing nitrogen and phosphorus components. An 11-month study demonstrated that raw screened wastewater applied to the trench system at a rate not exceeding 95 cu m/d (25,000 gpd) could be treated to secondary effluent quality. Spatial requirements were about the same as for a septic tank system.
W82-00093

**EVALUATION OF THE EFFECTIVENESS OF GRANULAR ACTIVATED CARBON ADSORPTION AND AQUACULTURE FOR REMOVING TOXIC COMPOUNDS FROM TREATED PETROLEUM REFINERY EFFLUENTS,**
Robert S. Kerr Environmental Research Lab., Ada, OK.
J. E. Matthews.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-199374, Price codes: A04 in paper copy, A01 in microfiche. Project Summary EPA-600/S2-81-067, July 1981. 4 p, 4 Tab.

Descriptors: *Industrial wastewater, *Oil industry, *Activated carbon, *Adsorption, *Aquaculture, *Wastewater treatment, Biological treatment, Organic compounds, Advanced wastewater treatment, Hydrocarbons, Toxicity.

Activated carbon adsorption isotherms of prepared aqueous solutions of toluene, 2,4-dimethylphenol, naphthalene, benzo(a)pyrene, chrysene, pyrene, acenaphthene, phenanthrene, fluoranthene, and fluorene were determined by laboratory studies to estimate the optimum loading capacity under ideal conditions. Effectiveness of activated carbon and aquaculture for removal of organic compounds from a treated petroleum refinery wastewater was evaluated with a pilot-scale treatment system onsite at a refinery. Activated carbon was shown to be effective in removing selected organic compounds; however, there was a wide variation in the adsorption capacities of the compounds tested. In general, adsorption capacity of activated carbon appears to decrease with an increase in the complexity of the polynuclear aromatic molecule. It would require relatively high dosages of carbon to remove the five-membered aromatic ring compounds. Advanced treatment using activated carbon or aquaculture appears to significantly improve petroleum refinery wastewater with respect to toxicity reduction. A literature review of activated carbon treatment indicated considerable variation in estimates for both capital investments and annual operating costs. (Moore-SRC)
W82-00098

**PHOSPHORUS DYNAMICS OF A FLORIDA FRESHWATER MARSH RECEIVING TREATED WASTEWATER,**
Florida Univ., Gainesville. Center for Wetlands.
For primary bibliographic entry see Field 5E.
W82-00108

**VIRUS REMOVAL IN WASTE STABILIZATION PONDS IN INDIA,**
National Environmental Engineering Research Inst., Nagpur (India).
V. C. Rao, S. B. Lakhe, and S. V. Waghmare.
Water Research, Vol 15, No 7, p 773-778, July, 1981. 7 Tab, 19 Ref.

Descriptors: *Viruses, *Stabilization ponds, Ponds, *Wastewater treatment, Ammonia, *India, Biological oxygen demand, Seasonal variation.

Stabilization ponds, a low cost waste treatment method used in India and other tropical developing countries, removed 86-95% of viruses from sewage on a pilot scale and 88-98% on a full scale. In the pilot tests, the percentage of virus removed was not significantly affected by rate of loading (205-472 lb BOD5 per acre per day), percentage of BOD5 removal (50-85%), and season (20-26 degrees C in winter and 30-35 in summer). Three 1-celled ponds of varying depths (3,4 and 5 ft, respectively) removed 66, 89, and 81% of the viruses in winter and 89-98% in fall, summer and rainy seasons. Depths of 3, 4, and 5 feet gave overall (averaging all seasons) removal efficiencies of 86, 95, and 93%, respectively. The anaerobic activity, causing frequent sludge uplift, in turn removed colloidal organics and viruses. Viruses were also removed by adsorption to suspended solids and subsequent settling to the extent of 63%. The free ammonia concentrations of 1.5-22 mg per liter and pH above 8.0 also contributed significantly to virus inactivation. (Cassar-FRC)
W82-00121

**ORGANIC MICROPOLLUTION INDICES OF EFFLUENTS AND RENOVATED WATERS,**
Technion-Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 5A.
W82-00123

**MODELING AMMONIUM EXCHANGE AND REGENERATION ON CLINOPTILOLITE,**
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
M. Semmens, J. Klieve, D. Schnobrich, and G. W. Tauxe.
Water Research, Vol 15, No 6, p 655-666, June, 1981. 14 Fig, 4 Tab, 6 Ref.

Descriptors: *Ammonium, *Ion exchange, *Computer models, Clinoptilolite, Model studies, *Wastewater treatment, Regeneration, Nitrogen compounds, Design criteria, Ammonium removal.

A computer model is presented to assist in the design of ammonium removal facilities in wastewater treatment plants. This predicts the exchange behavior of natural clinoptilolite, an ammonium selective ion exchanger, during service and regeneration. The regeneration model outputs may be used as inputs for the service model to evaluate the impact of alternative regeneration conditions on ammonium removal performance during service. The isotherms obtained in this study may be used to predict the influence of regeneration strengths between 0.2 and 0.4 M NaCl and ammonium concentrations of 5 to 40 mg per liter in influent wastewaters. (Cassar-FRC)
W82-00125

**METHANE PRODUCTION FROM OZONATED PULP MILL EFFLUENT,**
Purdue Univ., Lafayette, IN. Lab. of Renewable Resources Engineering.
C. E. Bremmon, M. F. Jurgensen, and J. T. Patton.
Journal of Environmental Quality, Vol 9, No 3, p 412-416, July-September, 1980. 2 Tab, 30 Ref.

Descriptors: *Pulp wastes, *Methane, Energy sources, Pulp and paper industry, Industrial wastes, Industrial plants, White water, Kraft mills, Sulfite liquors, Fermentation, Biodegradation, Anaerobic conditions, Sulfite mills, Sulfite liquors, *Waste treatment, *Secondary productivity.

The potential for producing methane from ozone-degraded spent sulfite liquor (SSL) by anaerobic fermentation was investigated. The ozonated SSL was fed continuously to three anaerobic fermenters for three months as the sole source of carbon and energy. The fermenters were inoculated with anaerobic bacteria obtained from sewage sludge and acclimated for one month in ozonated SSL prior to continuous fermentation. Chemical and biological parameters such as COD, BOD5, total sulfur content, redox potential, pH, fatty acid composition, and methane bacteria populations were monitored to determine changes in the SSL during fermentation. Methane production from ozone-treated SSL averaged 1.7 liters per liter, or 17 ml of methane produced per gram of volatile solids fed. Fatty acids analysis of fermenter effluent indicated a net production of 58 mM per liter of acetate during ozonated SSL fermentation. This acetic acid production shows future potential for further fermentation by protein-producing yeast. Although the rate of conversion of volatile solids to methane in this process was not competitive with domestic or agricultural waste digesters, the study did indicate the potential benefits of ozonating organic wastes for increased methane fermentation yields. (Baker-FRC)
W82-00155

**SURVIVAL OF EGGS AND LARVAE OF SWINE NEMATODE PARASITES IN AEROBIC AND ANAEROBIC WASTE TREATMENT SYSTEMS,**
Kansas Dept. of Health and Environment, Topeka.
O. G. Marti, C. V. Booram, and O. M. Hale.
Journal of Environmental Quality, Vol 9, No 3, p 401-405, July-September, 1980. 5 Tab, 17 Ref.

Descriptors: *Nematodes, *Waste recovery, Recycling, Waste treatment, Aerobic digestion, Anaerobic conditions, Temperature effects, Parasites.

Eggs and larvae of several genera of swine nematode parasites were studied in two experiments to determine their ability to survive aerobic and anaerobic treatment at two different temperature

levels, 12 and 22 degrees C. Swine feces containing eggs of Ascaris suum, Metastrongylus spp., Oesophagostomum dentatum, Hyostrongylus rubidus, and Strongyloides ransomi were used in both experiments. Treatment system fluids were sampled and examined periodically for parasite eggs and larvae. Cultures of fluids were prepared and examined for larvae after seven days of incubation at 25 degrees C. Ascaris eggs embryonated in 28 days in the 22 degree C aerobic system. Unembryonated Ascaris eggs in the other three treatment systems completed their development when transferred to two percent formalin at 25 degrees C. Metastrongylus eggs survived all treatment systems, but some larvae hatched and died. Oesophagostomum and Hyostrongylus larvae survived well under 12 degree aerobic conditions, but were destroyed in 11 days at 22 degrees C. Eggs of Strongyloides hatched rapidly under aerobic conditions, but survived at least seven days under anaerobic conditions in both experiments. The development of free-living adults of Strongyloides and the survival of third-stage larvae were favored in 22 degree C conditions. Knowledge of the parasite genera present in a swine herd and of the responses of eggs and larvae to different temperatures and treatments is significant for the effective management and safe recycling of waste materials. (Baker-FRC)
W82-00161

**LEACHATES FROM SOLID WASTE RECOVERY OPERATIONS,**
Brice, Petrides, and Associates, Inc., Waterloo, IA.
A. D. Rademaker, and J. C. Young.
Journal of the Energy Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EY1, p 17-29, May, 1981. 5 Fig, 7 Tab, 5 Ref.

Descriptors: *Wastewater treatment, *Leachates, *Waste recovery, *Wastewater renovation, Leaching, Heavy metals, Biological wastewater treatment, Biological treatment, Percolation, Soil types, Sludge, Pollutant identification, Organic wastes, Solid wastes.

A two phase study was conducted to determine the nature of residues produced at urban waste-to-energy conversion facilities and to evaluate leachates produced from the residues. Leachate samples were collected daily and analyzed weekly to see if heavy metals and organic priority pollutants could be leached in sufficient quantities to pose a potential environmental hazard. The effects of soil on the character of the resulting leachate produced from the selected waste residues were also examined. Bench scale column tests revealed that levels of effluent constituents declined gradually from a peak early in the leaching period to essentially zero at 5-7 weeks. Although no organic priority pollutants were found in ash residues, they were present in sludges from the biological treatment of pyrolysis waste waters. Soil columns were successful in removing most base-neutral extractable organic compounds, but not acidic extractable compounds. Some metallic priority pollutants were also removed upon contact with the soil. More research is required into better techniques for removing compounds from solid residues, the identification of organic priority pollutants, and designing models to describe the leaching of priority pollutants from landfills. (Geiger-FRC)
W82-00167

**REFUSE-TO-ENERGY WASTEWATER TREATMENT,**
Montgomery (James M.), Inc. Pasadena, CA.
G. P. Treweek.
Journal of the Energy Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EY1, p 1-16, May, 1981. 4 Fig, 5 Tab, 22 Ref.

Descriptors: *Fuel, *Wastewater treatment, *Wastewater renovation, Incineration, Anaerobic digestion, Biological treatment, Trace metals, Organic wastes, Waste recovery, Waste characteristics, Waste disposal, Wastewater disposal, Pilot plants, Wastewater facilities, Biological wastewater treatment.

A two step procedure consisting of preprocessing and conversion is described for processing wastewater refuse into useable fuel. Preprocessing consists of a series of physical steps to size, classify, and separate the refuse, while conversion is carried out by combustion, pyrolysis, anaerobic digestion, or methanation, depending upon the process used for preparing the municipal solid wastes (MSW). Wastewaters from combustion processes consist mainly of site drainage and wash waters, quench and sluice waters, boiler blowdown, and scrubber effluent. The first three wastewaters may be handled by sanitary sewers. The treatment of scrubber wastewater may involve the removal of trace metals before discharge into sanitary sewers. Pyrolysis of preprocessed MSW results in the production of a gas, an oily or liquid fraction, and a solid char fraction. Wastewaters produced during pyrolysis contain high levels of organic priority pollutants. Anaerobic digestion of MSW is still in the development stage, and a test site at Pompano Beach, Florida anticipates wastewater streams from storage pit drainage and liquid effluent generated from dewatering the digested sludge. Projected treatment facilities and recommended pilot plant studies for the handling of wastes for fuel conversion are described. (Geiger-FRC)
W82-00168

**FOAM CONTROL IN AERATION TANKS,**
Los Angeles County Sanitation Districts, Whittier, CA.
W. W. Hoffmaster.
Water/Engineering and Management, Vol 128, No 5, p 84, 89, May, 1981. 1 Fig, 2 Tab.

Descriptors: *Foam separation, *Foaming, *Aeration, *Wastewater treatment, Pumps, Sprays, Mechanical equipment, Performance evaluation.

A mechanical foam breaker was tested at an activated sludge wastewater treatment plant. Foam control for aeration tanks in Los Angeles County Sanitation Districts consists of foam sprays and vacuum pumps. Foam sprays are a set of nozzles spaced about 6.5 ft apart. These physically break up the bubbles. Greater control is provided by the vacuum pumps. The pumps suck the foam off the surface of the tanks and thus limit foam production by removing it. During the tests of the rotating brush type breaker, the 37.5 mgd plant, which consisted of 12 aeration tanks, was being operated in a contact stabilization mode. The depth of foam was approximately six to eight in. The unit reduced the foam cover by 223 sq ft in 95 min when the tank was baffled at 32.5 ft. Eighty-four percent of the foam was reduced within 10 minutes. In an unbaffled tank running continuously, the foam splitter maintained a difference of 3.4 ft of uncovered foam. A thin layer of scum was a by-product of the system, but the splitter was much cheaper than a suction device which would eliminate the scum. (Small-FRC)
W82-00171

**GREECE WON'T BE LETTING WASTEWATER PROBLEMS SLIDE.**
Water and Sewage Works, Vol 127, No 2, p 54, 59, February, 1980.

Descriptors: *Greece, Athens, *Wastewater facilities, Wastewater management, Wastewater treatment, Municipal wastewater.

Several recent events in Greece have led that country to take action in the water pollution field. The first municipal wastewater treatment plant had been built in the central part of the country. Athens, the largest city, with nearly 1 million people in the greater metropolitan area, expects to get underway with a design for its first treatment plant as well. The extremely heavy direct disposal of untreated wastes into offshore waters has severely harmed the fishing industry, on which the country depends heavily. Greece will also need to achieve some level of compliance with the EEC pollution control standards before becoming a full member of the common market. Shortly after World War II, a start was made toward the fine, well-engineered, constantly expanding water system enjoyed in Athens today. Athens receives good quality mountain stock water in plentiful supply; it is subjected to treatment such as coagulation with alum, filtration and chlorination at 7 ppm. (Baker-FRC)
W82-00182

**TOTAL ORGANIC HALOGEN AS A PARAMETER FOR THE CHARACTERIZATION OF RECLAIMED WATERS: MEASUREMENT, OCCURRENCE, FORMATION, AND REMOVAL,**
Karlsruhe Univ. (Germany, F.R.). Dept. of Water Chemistry.
M. R. Jekel, and P. V. Roberts.
Environmental Science and Technology, Vol 14, No 8, p 970-975, August, 1980. 2 Fig, 5 Tab, 23 Ref.

Descriptors: *Chemical analysis, *Organic compounds, *Reclaimed water, Water use, Water analysis, Measuring instruments, Water pollution control, Drinking water, Halogens.

A method is described for the determination of total organic halogen whereby purgeable and nonpurgeable fractions are measured separately. The detection limits are 0.03 micromol/liter halogen for the purgeable fraction and 1.0 micromol/liter halogen for the nonpurgeable fraction. Precision is 5%. Data are presented from two water-reclamation facilities in California. The treated wastewater (secondary effluent) contains 1.0 to 10 micromol/liter total organic halogen, mostly in the nonpurgeable fraction. The mole ratio of organic halogen to organic carbon is about 0.4 to 1.2%. Nonpurgeable halogenated organics are formed during chlorination. The halogenated compounds are removed in several treatment steps: air stripping is effective in decreasing the concentration of the purgeable fraction; activated-carbon and reverse-osmosis treatment substantially reduce the concentration of the nonpurgeable fraction. The halogenated organics remaining after water reclamation appear to be highly mobile in the groundwater environment. Considering the potential health effects of halogenated organics in drinking water, their removal should be considered a major treatment objective in water reclamation. (Baker-FRC)
W82-00197

**ASSIMILATION OF LEMONADE-PROCESSING WASTEWATER BY YEASTS,**
New York State Agricultural Experiment Station, Geneva. Dept. of Food Science and Technology.
Y. D. Hang.
Applied and Environmental Microbiology, Vol 39, No 2, p 470-472, February, 1980. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Wastewater treatment, *Food processing industry, Food-processing wastes, Industrial wastes, *Yeasts, Fungi, Growth, Temperature effects, Acidity, Citric acid, Lemonade processing.

The ability of various yeasts to grow on the waste effluents generated during the processing of lemonade was investigated. Five species of yeasts were examined, but only Candida utilis and Saccharomyces fragilis reduced the BOD by greater than 60%. However, C. utilis settled very slowly. In contrast, S. fragilis settled very rapidly and compacted well, and up to 95% of the yeast solids settled in 15 minutes. For this reason in particular S. fragilis is a more desirable organism for treating lemonade-processing wastewater than C. utilis. S. fragilis competed successfully with the natural biota in the wastewater. There were no marked differences between yeast growth in the autoclaved and unautoclaved waste material. Biochemical changes during fermentation of lemonade-processing wastewater by S. fragilis were determined. The amount of yeast growth approximately paralleled the reduction of BOD in the waste water. Both yeast growth and BOD reduction increased rapidly between 12 and 24 hr and reached maxima in 32 hr. The BOD was reduced from 4,100 to 550 mg/liter, representing a reduction of about 87%. Concurrently, the titratable acidity calculated as citric acid was reduced from 0.52% to 0.012% and the pH was raised from 3.0 to 6.8. S. fragilis was able to grow rapidly over a wide range of temperatures, but the optimum temperature was 30 degrees C. Yeast cells grown at 23

to 35 degrees C settled more rapidly than those grown at 40 to 45 degrees C. (Baker-FRC)
W82-00204

**REMOVAL AND RECOVERY OF ORGANIC POLLUTANTS FROM THE AQUATIC ENVIRONMENT. 2. REMOVAL AND RECOVERY OF DODECYLBENZENESULFONATE FROM AQUEOUS SOLUTION BY CROSS-LINKED POLY(N-BENZYL-4-VINYLPYRIDINIUM HALIDE),**
Kyoto Inst. of Tech. (Japan). Dept. of Chemistry.
N. Kawabata, and T. Morigaki.
Environmental Science and Technology, Vol 14, No 9, p 1089-1093, September, 1980. 4 Fig, 3 Tab, 5 Ref.

Descriptors: *Surfactants, *Resins, *Separation techniques, Organic chemicals, Water pollution control, Adsorbents, Chemical analysis, Anionic surfactants, Dodecylbenzenesulfonate.

An attempt was made to find a new polymeric adsorbent for removal and recovery of sodium dodecylbenzenesulfonate from aqueous solution, which would be more useful than those presently available. Vinylpyridine-divinylbenzene copolymer was used as a polymeric adsorbent for removing DBS from solution. BVP resin in the bromide form was found to have an excellent capacity for removing sodium dodecylbenzenesulfonate from solution. The breakthrough capacity of the resin with less than 1 ppm leakage in the effluent was greater than those observed with commercial anion exchange resins and porous styrene-divinylbenzene resin with no ion exchange functional group. The breakthrough capacity of the BVP resin for DBS adsorption was scarcely affected by the presence of sodium chloride, sodium sulfate, sodium hydroxide, and hydrochloric acid. Elution of the adsorbed DBS from the BVP resin was easily accomplished by a simple treatment with methanolic hydrochloric acid, and the BVP resin was efficiently regenerated as the chloride form. DBS was concentrated into 20-25 wt% solution. The BVP resin in the chloride form showed much the same ability for the adsorption of DBS as the resin in the bromide form. (Baker-FRC)
W82-00217

**EVALUATION OF THE OVERLAND RUNOFF MODE OF LAND WASTEWATER TREATMENT FOR VIRUS REMOVAL,**
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5B.
W82-00220

**TREATMENT OF POTATO-PROCESSING WASTE WATER BY AN ANAEROBIC LAGOON-FILTER SYSTEM,**
New Brunswick Univ., Fredericton. Dept. of Civil Engineering.
K. C. Lin, and G. J. Brown.
Canadian Journal of Civil Engineering, Vol 7, No 2, p 373-383, 1980. 9 Fig, 2 Tab, 12 Ref.

Descriptors: *Anaerobic lagoons, *Potato wastes, *Food processing industry, *Wastewater treatment, Biological treatment, Lagoons, Filters, Industrial wastewater, Organic loading.

A laboratory-scale model of an anaerobic lagoon followed by anaerobic filtration was very efficient in treating potato processing wastewater. At 20 degrees C, pH 7, and organic loading rates of 0.149, 0.290, and 0.719 kg BOD per cu meter per day, overall removals of COD and suspended solids were 97-98% and 89-97%, respectively. The system operated well under shock loads and under zero loads. Most BOD and suspended solids were removed in the bottom part of the reactors. Optimum load to the lagoon and filter were 0.3 and 0.4 kg BOD per cu meter per day, respectively. pH was maintained at 7 by sodium bicarbonate addition. Sludge buildup was estimated at less than 30% of the lagoon volume in 50 years. Therefore, no sludge removal would be required during the normal design period. Filter clogging is also unlikely. (Cassar-FRC)
W82-00226

**AMES' MUTAGENIC ACTIVITY IN RECYCLED WATER FROM AN ISRAELI WATER RECLAMATION PROJECT,**
Johns Hopkins Univ., Baltimore, MD. Dept. of Environmental Health Sciences.
I. Neeman, R. Kroll, A. Mahler, and R. J. Rubin.
Bulletin of Environmental Contamination and Toxicology, Vol 24, No 1, p 168-175, January, 1980. 2 Fig, 1 Tab, 16 Ref.

Descriptors: *Recycling, *Water shortage, Water demand, Waste recovery, *Water reuse, Mutagenic activity, Eutrophication, Algae, Wastewater treatment, Carcinogens, *Israel.

A project using eutrophication of sewage water has recently reached the final stages of development at a major facility located south of Tel Aviv, Israel, as part of that country's attempts to reclaim water for human and agricultural uses. Samples of water were collected from two sites in the polishing ponds and from a well located adjacent to the polishing ponds. A non-polar resin was also used to concentrate potential mutagenic materials in the water collected from the polishing pond at the terminal end of the reclamation project. The water samples and the concentrated samples were tested by the Ames assay system. The results reveal the presence in recycled water of low levels of one or more pro-mutagens that require activation by mammalian host factors prior to exhibiting mutagenic activity. The data indicate an absence of a response to unconcentrated water in one tester strain, TA 98, with a positive response in a second strain, TA 100. This coupled with a marked response in both strains to concentrated water extracts. In any case the demonstration of pro-mutagenic activity in various water samples drawn from the recycling facility is clear. The source of this lipophilic pro-mutagenic activity may be directly from industrial or agricultural pollutants or indirectly from microbial action on the myriad organic chemicals present in the oxidation ponds. (Baker-FRC)
W82-00234

**CONCENTRATION OF POLIOVIRUS IN WATER BY MOLECULAR FILTRATION,**
Environmental Monitoring and Support Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W82-00246

**ANAEROBIC TREATMENT OF HUMAN WASTE IN NORTHERN COMMUNITIES,**
Toronto Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W82-00249

**DESIGN GUIDELINES FOR INCOMPLETELY MIXED OR AEROBIC-ANAEROBIC AERATED LAGOONS,**
Nova Scotia Technical Coll., Halifax. Dept. of Civil Engineering.
D. Thirumurthi.
Canadian Journal of Civil Engineering, Vol 7, No 1, p 27-35, 1980. 7 Fig, 3 Tab, 12 Ref.

Descriptors: *Aerated lagoons, *Design criteria, *Aerobic-anaerobic lagoons, Lagoons, *Wastewater treatment, Municipal wastewater, Biological oxygen demand, Organic loading.

Incompletely mixed (aerobic-anaerobic) aerated lagoons can be designed using the Thirumurthi chart, which graphically depicts the Wehner-Wilhelm equation for biological wastewater treatment applications. The biological factors (temperature and wastewater quality) are delineated by a first-order BOD removal coefficient; the physical-hydraulic regimes (mixing pattern and depth-width ratio of lagoon) are represented by a dispersion index. The key to the design is the standard BOD removal coefficient (K), 0.29 per day, for municipal wastewater at a standard temperature of 20 degrees C and organic loading of 20 kg per cu meter per day. Equations for correcting K are provided for actual cases where temperature and organic load differ from the standard. An example design (an aerated lagoon operating in winter) illustrates the design procedure, which should be verified by monitoring the field installation. (Cassar-FRC)
W82-00250

**POLLUTANT TREATABILITY: A MOLECULAR ENGINEERING APPROACH,**
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W82-00252

**RECOVERY OF INDIGENOUS VIRUSES FROM WASTEWATER SLUDGES, USING A BENTONITE CONCENTRATION PROCEDURE,**
Texas Univ. Center for Applied Research and Technology at San Antonio.
C. A. Turk, B. E. Moore, B. P. Sagik, and C. A. Sorber.
Applied and Environmental Microbiology, Vol 40, No 2, p 423-425, August, 1980. 2 Tab, 6 Ref.

Descriptors: *Viruses, *Sludge, *Wastewater treatment, Adsorption, Bentonite, Monitoring.

An adaptation of the bentonite virus concentration procedure to sludges has been developed. The results were obtained by the distilled water elution-bentonite concentration procedure in viral monitoring of liquid sludges undergoing land application at six sites in the United States. Plaque assays for indigenous and seed viruses were performed with confluent monolayers of HeLa cells grown in 100-mm petri plates. Several sludge dispersion techniques, isolating indigenous viruses, were evaluated on primary raw and digested sludges. Bentonite adsorption was accomplished by adding 200 mg bentonite clay per liter, previously expanded by vigorously mixing 1 g of bentonite in 100 ml of distilled water for 1 hr, to the sludge eluate. Calcium chloride was added to give a final concentration of 0.02 M, the pH was adjusted to 6.0 with 1 N HCl, and the sample was mixed for 30 min. Bentonite was recovered by centrifuging the sample at 3,000 x g for 10 min. Levels of enteric viruses detected in field samples ranged from a high value of 215 plaque-forming units per g total suspended solids to a low of 0.2 plaque-forming unit per g. During the monitoring program a total of 64 samples were handled, with 97% yielding viruses by the methodology described. Sample volume reductions expressed as a concentration factor generally exceeded 15. Thus the versatility of the bentonite concentration procedure was demonstrated by the recovery of indigenous virions from primary raw sludges during lab testing and from anaerobically digested and lagooned sludges during field monitoring. (Baker-FRC)
W82-00271

**THE ALPHA-BETA-GAMMA'S OF WASTEWATER TREATMENT,**
Standard Oil Co., Chicago, IL.
J. F. Grutsch.
Environmental Science and Technology, Vol 14, No 3, p 276-281, March, 1980. 5 Fig, 1 Tab, 6 Ref.

Descriptors: *Wastewater treatment, *Activated sludge, Petroleum industry, Organic compounds, Activated carbon, Adsorbents, Carbon, Sludge, Oil refineries, Refinery wastes.

Operation at high sludge age and further enhancement by using high concentrations of powdered activated carbon (PAC) commingled with the activated sludge are two approaches used by the petroleum refining industry to improve the performance of activated sludge processes for the removal of organics from wastewater. The key to operating the activated sludge process (ASP) in the high-sludge-age mode is to recognize the impact of influent solids on the physical properties of the activated sludge, specifically the zeta potential probability distribution. High-sludge-age ASP data indicate that the bacteria use food resources sequentially. First, the cell's energy requirements are met. Then, if pool resources remain, the macromolecules are synthesized. Sequential utilization of

food resources is not unexpected, as the energy resource must exist to construct and locate the macromolecules. In studies where a municipal plant operated at exceptionally high sludge age, the solids equilibrated and the plant operated for 3+ months with no sludge wastage, and about 4 mg/liter solids were lost to the effluent. The hydraulic design of the ASP has a striking impact on which metabolic route of the substrate is used - the biosynthetic fate (alpha) or maintenance energy (beta). (Baker-FRC)
W82-00275

**A 201 POLLUTION CONTROL PLANNING TRAGEDY,**
For primary bibliographic entry see Field 6E.
W82-00285

**THE CONSULTANT'S VIEWPOINT ON ALTERNATIVE DISINFECTANTS,**
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W82-00286

**SLUDGE SETTLING HAMPERED BY INDUSTRIAL DISCHARGE,**
Williamsport Sanitary Authority, PA.
M. H. Gerardi.
Public Works, Vol 112, No 6, p 95-97, June, 1981. 1 Tab, 11 Ref.

Descriptors: *Sludge conditioning, *Sludge digestion, *Bulking sludge, *Industrial waste, *Biochemical oxygen demand, Sludge, Biodegradation, Digestion, Sludge filters, Organic compounds, Flow discharge, Bacteria, Wastewater, Wastewater treatment, Settleable solids, *Williamsport, Pennsylvania.

In Williamsport, Pennsylvania, poor sludge settling due to gas entrapment by mixed-liquor filamentous organisms was attributed to discharge of a fatty acid derivative waste from food emulsifiers. Filamentous bulking is a major operation nuisance for many activated sludge wastewater treatment plants. The nuisance bacteria possess three outstanding metabolic properties: production of filaments under low dissolved oxygen concentrations, rapid assimilation of organic compounds into lipids, and conversion of nitrites to nitrogen during microbiological denitrification. Treatment measures that have been practiced with some success include the use of return sludge chlorination, decreased mean cell residence time, decreased mixed liquor suspended solids concentration, and return of anaerobic digester supernate. In Williamsport, equalized flow discharge from the manufacturer improved settleability. Pretreatment with ferric chloride and calcium hydroxide followed by dissolved air flotation has been proposed as an alternative control measure. (Titus-FRC)
W82-00290

**EFFECTS OF ALPHA, BETA AND THETA FACTOR UPON THE DESIGN, SPECIFICATION AND OPERATION OF AERATION SYSTEMS,**
California Univ., Los Angeles. School of Engineering and Applied Science.
M. K. Stenstrom, and R. G. Gilbert.
Water Research, Vol 15, No 6, p 643-654, 1981. 3 Fig, 4 Tab, 80 Ref.

Descriptors: *Aeration, *Design criteria, *Wastewater treatment, Dissolved oxygen, Oxygen transfer, Turbulence, Surfactants, Mass transfer, Bubbles, Alpha factor, Beta factor, Theta factor, Variability, Suspended solids, Temperature, Research priorities, Literature review.

This literature review on alpha, beta, and theta factors in wastewater aeration is the result of work by a subcommittee of a joint EPA-American Society of Civil Engineers group in developing a manual of practice for aerator testing and specifications. The variability of the alpha factor has produced values in the literature from 0.3 to 2.0. It depends on many factors: wastewater quality, mixing, suspended solids concentration, bubble diameter, scale, and especially the method of aeration. An alternative approach to determining the alpha factor, using a synthetic anionic surfactant in the test water, is suggested for further development. The beta factor, or ratio of the saturation dissolved oxygen concentration in clean water, may be measured by the Winkler method if no chemical interferences exist. Otherwise, it should be calculated from a total dissolved solids measurement. Values for the beta factor are about 0.95 for domestic wastewater. Values for the beta factor are about 0.95 for domestic wastewater, 0.77-0.97 for pulp mill wastes. Determination of the beta factor also produces a diversity of values. Temperature correction factors have been reported over the range 1.008 to 1.047 and are dependent on turbulence. A theta factor of 1.024 is suggested for most applications. The many uncertainties involved in the use of these three factors show a need for research on the subject, giving high priority to explanations of the effects of turbulence on alpha and beta factors and analysis of scale-up effects on changing surface tension and oxygen diffusivity. (Cassar-FRC)
W82-00291

**ROLE OF HYDRODYNAMIC FACTORS IN AMMONIA DESORPTION BY DIFFUSED AERATION,**
New York State Dept. of Health, Albany. Div. of Lab. and Research.
E. Shpirt.
Water Research, Vol 15, No 6, p 739-743, 1981. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Ammonia, *Aeration, *Hydrodynamics, *Wastewater treatment, Mass transfer, Mathematical equations, Turbulence, Air-water interfaces, Bubbles.

The rate of ammonia removal from water by diffused aeration was described by an equation derived from dimensional analysis and the theory of models. This is relevant to stripping of ammonia from wastewater. The mass transfer process was correlated with hydrodynamic variables reflecting the geometry of the system, the air flow, and the liquid properties (diameter and velocity of the rising bubbles in the water, depth of submersion of the diffusers, and the rate of aeration). Experiments were done at water column levels of 30, 50, and 100 cm and at 3.38, 6.75, 13.50, and 27.0 cu meters per sq meter per hour using tap water at 20 degrees C. Fine bubble aeration was twice as efficient in ammonia removal as coarse bubble aeration. (Cassar-FRC)
W82-00293

**THE OPERATION OF A WASTE TREATMENT PLANT. PROCESS DYNAMIC CONSIDERATIONS,**
Westvaco Corp., Laurel, MD.
R. P. Wilcox, and J. S. Hudgins.
Tappi, Vol 63, No 2, p 115-117, February, 1980. 5 Fig.

Descriptors: *Pulp and paper industry, *Settleable solids, *Wastewater treatment, Industrial wastewater, Model studies, Kraft mills, Wood wastes, Activated sludge process.

A simple dynamic flow model was developed to predict how materials are propagated through a waste treatment plant. The dynamics were evaluated by treating each of the plant units (primary clarifier, aeration basin, secondary clarifier) as a mixing tank and using Laplace transforms to represent the transfer functions for it. The overall transfer functions are given by the product of the individual transfer functions. Two concentrations were of principal interest: the concentration of the material in the aeration basin (important because of possible inhibiting effects on microorganisms) and the concentration in the secondary clarifier, because of effects the material may have in directly altering settleability. The model was applied to a treatment plant in a southern kraft paper mill. Uses of the model include estimating the maximum entering composition of a material which will not exceed plant capacity. Results apply mainly to nonbiodegradable material such as lignin or inorganics. Substances contributing to BOD are degraded by biological action in an aeration basin and can be included in the model with an additional term. (Cassar-FRC)
W82-00298

**LUXURY UPTAKE OF NITROGEN IN FLOCCULATING ALGAL-BACTERIAL SYSTEM,**
Government Engineering Coll., Trichur (India). Dept. of Civil Engineering.
K. R. Nambiar, and S. D. Bokil.
Water Research, Vol 15, No 6, p 667-669, 1981. 1 Fig, 1 Tab, 16 Ref.

Descriptors: *Nitrogen removal, *Algae, *Bacteria, Biomass, *Wastewater treatment, Nitrogen compounds, Flocculation.

Investigations were conducted, aimed at increasing nutrient removal from fertilizer manufacturing wastewater by a mixed algal-bacterial biomass. Although algae and bacteria nitrogen uptake rates are usually 8-12%, a 16% uptake (luxury uptake) was obtained with added carbon source and added N. In four 3-liter batch reactors fed with 700 mg per liter ammonia-N, 300 mg per liter urea-N, glucose, and phosphate, the flocculating algal-bacterial biomass decreased during the 10-day test, but biomass N remained in the 500 mg per liter range. A C:N:P ratio of 10:10:1 (as against the stoichiometric ratio of 30:10:1) is the optimum for biomass stability and total N removal efficiency. (Cassar-FRC)
W82-00307

**SMALL IS ENVIRONMENTALLY ACCEPTABLE . . .,**
Water Pollution Research Lab., Stevenage (England).
M. J. D. White.
Water, No 33, p 15-17, July, 1980.

Descriptors: *Wastewater treatment, *Biological wastewater treatment, Anaerobic digestion, Fluidized bed process, Fluidized beds, Dewatering, Separation techniques.

Increasing environmental pressure and space restrictions have led to greater interest in methods for intensifying wastewater treatment processes. Biological degradation and solid/liquid separation comprise the two major types of sewage treatment processes. Both are amenable to intensification options. Biological treatment can be intensified by increasing the number of microorganisms per unit volume. This may be accomplished by increasing the quantity of oxygen supplied during aeration prior to separation in a settlement tank or by using small filter media with a larger surface area rather than traditional filters with mineral media. Biological fluidized beds provide potential for achieving concentrations of microorganisms which are five to ten times greater than those achieved by conventional activated sludge processes. However, subsequent aerobic treatment requires a high rate of oxygen input due to the high concentrations of microorganisms, resulting in high operating costs. The fluidized bed process can be used for anaerobic treatment of industrial wastes containing carbohydrate but not much ammonia or other pollutants. Concentration of sludge prior to anaerobic digestion can reduce the retention period by as much as 65% and results in reduced volume to be treated. The potential for intensification of the separation processes used in sewage treatment appears to be rather limited. Such measures as are feasible are relatively expensive either to construct or to operate. (Carroll-FRC)
W82-00311

**PILOT SCALES TESTS ON THE FLOTATION OF ABATTOIR WASTES BY DEEP U TUBES,**
Manchester Inst. of Science and Technology (England).
A. D. Wheatley, and S. J. Denham.
Effluent and Water Treatment Journal, Vol 20, No 6, p 274-277, June, 1980. 2 Fig, 8 Tab, 5 Ref.

Descriptors: *Meat processing industry, *Flotation, Animal wastes, Recycling, *Wastewater treatment, Pilot plants.

A portable pilot plant was used to test treatment of strong and variable abattoir wastes (up to 3294 mg per liter COD) using the flotation method. The distinguishing feature of the plant was a U-tube shaft. With recycle, total suspended solids removals were over 95%. Without recycle, several problems prevented good results--interference of gas transfer, coagulation by the strong effluent, and inadequate gas precipitation. Corrective measures included increasing residence times in the flotation tank by 2 or 3 times, raising the temperature, adding new particulate matter, and addition of coagulants directly to the shaft. Several experimental procedures--providing gas bubbles as nucleation sites and preaeration prior to entering the shaft--produced no improvement in results. Experiments to selectively remove protein were unsuccessful using sodium hexametaphosphate as a coagulant at low pH, a recycle ratio of 4:1, and a reduced flow rate. (Cassar-FRC)
W82-00322

**A REALISTIC ASSESSMENT OF THE EFFECT OF SETTLEMENT ON SEWAGE,**
T. Stones.
Effluent and Water Treatment Journal, Vol 20, No 3, p 119, 121, March, 1980. 5 Tab, 4 Ref.

Descriptors: *Chemical oxygen demand, *Flocculation, Biological oxygen demand, Nitrogen compounds, Suspended solids, *Wastewater treatment, Industrial wastewater.

Total oxygen demand (COD plus nitrogenous oxygen demand) is a more realistic measure of the effect of settlement in sewage than previously used methods. Samples of domestic sewage, both natural and sterilized, were allowed to settle for 18 hours. Of the total reduction in oxygen demand, 91.2% was due to carbonaceous matter and 8.8% due to nitrogenous matter. Overall, 30.3% of the reduction arose from biological activity. Settlement resulted in a reduction of 35.8% of the initial COD, which is equivalent to a reduction of 29.3% of the initial TOD; and a reduction of 15.7% of the initial nitrogenous oxygen demand, which is equivalent to 2.8% of the initial TOD. Data for settlement of industrial sewage showed a marked suppression on the proportion of the reduction of the COD from biological activity because of toxic materials in the sewage. (Cassar-FRC)
W82-00324

**CHEMISTRY OF SEPTICITY,**
Severn-Trent Water Authority, Birmingham (England).
N. Harkness.
Effluent and Water Treatment Journal, Vol 20, No 1, p 16, 18-19, 21, 23, January, 1980. 2 Fig, 9 Ref.

Descriptors: *Sepsticity, *Hydrogen sulfide, *Anaerobic conditions, *Odors, Sulfur compounds, Chemical reactions, Sulfides, Organic compounds, Sewer systems, Bacteria, Sulfates, Industrial wastes, Domestic wastes, Amines, Amino acids, Organic matter.

Malodors in sewage result from a variety of biochemical reactions taking place in the absence of free or combined oxygen. The most common, hydrogen sulfide, arises under anaerobic conditions from the breakdown of sulfur-containing organic compounds in a reduced state and from sulfate-sulfur. Examples are amino acids, vitamins, taurine, arylsulfate acids, steroid sulfates, and sulfomucopolysaccharides. These compounds may enter a sewer system from domestic sources (1.0-1.5 g S per person per day), potable water, surface and infiltration water, and industrial effluents. Pomeroy's Z formula allows estimation of the likelihood of sulfide formation in gravity sewers, considering BOD, temperature, slope of sewer, sewage flow, and ratio of pipe wall perimeter to surface width of flow. Low pH, high temperature, and turbulent flow enhance hydrogen sulfide liberation into the atmosphere. Molecular H2S comprises half the soluble sulfide at pH 7 and 15C, increasing with decreasing pH; at 20C the atmospheric equilibrium concentration is 130 ppm for 0.5 mg per liter H2S in solution. Other malodors possible in sewage are volatile fatty acids, alcohols, ketones, and amines. (Cassar-FRC)
W82-00325

**ADVANCED BIOLOGICAL TREATMENT OF TANNERY WASTEWATER,**
D. R. Refling, M. G. Biesinger, and L. K. Barber.
Industrial Wastes, Vol 27, No 3, p 16-18, May/June, 1981. 2 Fig, 4 Tab.

Descriptors: *Wastewater treatment, *Tannery wastes, Industrial wastes, Primary wastewater treatment, Oxidation ponds, Advanced wastewater treatment, Aeration, Aerators, Winchester, New Hampshire.

Wastewater from tanneries is a complex mixture of organic and inorganic chemicals. It is high-strength and extremely variable in nature. Nearly all of the wastewater from the A. C. Lawrence Tannery in Winchester, New Hampshire, is discharged from 3 am to 7 pm, with the peak occurring about 11 am. The permit issues for this discharge specified that effluent concentrations should not exceed: suspended solids, 60 mg/l; BOD, 15 mg/l; ammonium-nitrogen, 1.5 mg/l; FOG, 15 mg/l; and chromium, 1.0 mg/l. Treatment at the plant consists of a primary chemical treatment system followed by an advanced biological secondary system. In the primary system the wastewater is dosed with 1,000 mg/liter alum and 800 mg/liter lime. Wastewater pH is controlled between 7.5 and 8.5. Wastewater then flows through a dispersed air device and a vortex coagulation cell and on to an electro-flotation tank where small gas bubbles attach to the floc particles and float them to the tank surface, where they are removed by skimmers. Polyelectrolyte is injected at a dose of 12 mg/liter just prior to flotation. The biological treatment uses an aeration and mixing system called Carrousel, which is essentially a modification of the Pasveer oxidation ditch concept using low-speed surface aerators instead of horizontal rotors. The effluent produced has been determined to be of extremely high quality, with average effluent BOD values of 5 mg/liter in summer and 6 mg/liter in winter. Effluent ammonia nitrogen values are 1 mg/liter in summer and 4 mg/liter in winter. Over 99% of the raw influent BOD was removed, and nitrogen removal efficiencies were 85.2-89.8%. (Baker-FRC)
W82-00337

**RECENT DEVELOPMENTS IN WATER POLLUTION CONTROL,**
Toronto Univ. (Ontario). Dept. of Civil Engineering.
J. G. Henry.
Canadian Journal of Civil Engineering, Vol 7, No 2, p 264-272, 1980. 40 Ref.

Descriptors: *Wastewater treatment, *Water pollution control, *Ontario, *Canada, Performance evaluation, Process control, Automation, Activated sludge process, Oxygen, Biological treatment, Rotating biological contactors, Deep shaft process, Fluidized bed process, Land application, Physicochemical treatment, Anaerobic digestion, Incineration, Sludge disposal, Sludge dewatering, Dewatering, Research priorities.

This paper examines the current status of municipal wastewater technology in Ontario, Canada, and recent developments in plant performance, secondary treatment, and sludge processing. These are reviewed with respect to limitations and suitability for Canada. Still in a primitive stage are dynamic design, mathematical modeling for unit processes, and automatic process control. Secondary treatment processes which show promise are the oxygen activated sludge process for large plants, fixed film reactors (such as the rotating biological contactor) for small municipalities, the deep shaft process, and the fluidized bed technique. Land treatment and physical-chemical treatments (activated carbon) are considered impractical for Canada. Sludge processing, which accounts for 40% of wastewater treatment costs, presents many problems. Anaerobic digestion is difficult to operate, and land application is severly restricted. Possible answers to sludge problems are incineration, new dewatering devices such as belt filters, and polymeric sludge conditioners. Research and development on water treatment in Canada must increase. (Cassar-FRC)
W82-00340

**TEXTILE EFFLUENTS LOSE THEIR COLOR.**
Canadian Chemical Processing, Vol 64, No 2, p 75, March, 1980.

Descriptors: *Color removal, *Textile mill wastes, *Activated carbon, Dyes, *Wastewater treatment, Industrial wastewater.

An activated carbon system was installed in the Harding Carpets factory to treat a highly variable effluent containing textile dyes and other chemicals. A 14.2 cu m holding tank equalizes the waste load. Each carbon bed is 0.9 m in diameter and 3.2 m long and can handle 0.19 cu m per hour of effluent. The entire system, with a 326 cu m per day capacity, removes 95.4% of the color. Significant reductions in total organic carbon, chemical oxygen demand, and biological oxygen demand of the effluent are effected. (Cassar-FRC)
W82-00342

**PULP COMPANIES FACE BILLION DOLLAR CLEANUP.**
Canadian Chemical Processing, Vol 64, No 1, p 18-19, February 6, 1980.

Descriptors: *Pulp and paper industry, *Water pollution prevention, *Bleaching wastes, Kraft mills, Canada, *Wastewater treatment, Industrial wastewater, Effluents, Regulations, Recycling, Chlorination, Costs.

Spending on pollution control in the Canadian pulp and paper industry will increase from the traditional 5-10% of capital expenditures as environmental guidelines become stricter. Methods used to reduce pollution costs include the closed-cycle kraft mill concept, contercurrent methods, recycling spills, burning toxic materials, improved housekeeping, increased use of chlorine dioxide, oxygen bleaching, and reducing bleach volumes by the dynamic bleaching process. (Cassar-FRC)
W82-00343

**AVOIDING AN ENVIRONMENTAL HANGOVER.**
Canadian Chemical Processing, Vol 64, No 2, p 29-30, March, 1980.

Descriptors: *Brewery industry, *Aerated lagoons, Lagoons, *Wastewater treatment, Industrial wastewater, Food processing industry.

Brewery wastes at Molson's Barrie, Ontario, plant are treated on site before release into the municipal treatment system. The plant generates 0.5 to 1 million gal per day of effluent with BOD of 1500-2000 ppm. The wastes are treated in two 2 million gallon lagoons equipped with conventional paddle surface aerators and a Penberthy aerator with a Venturi system. Effluent from the lagoons passes through two clarifiers. Sludge is collected, dewatered to 14% solids concentration, and disposed at a municipal site. Treated effluent is discharged to the municipal system at less than 300 ppm BOD and 350 ppm suspended solids. (Cassar-FRC)
W82-00344

**RAPID GROWTH FORECAST FOR PEROXIDE.**
Canadian Chemical Processing, Vol 64, No 1, p 21-22, February 6, 1980.

Descriptors: *Hydrogen peroxide, *Hydrogen sulfide, Oxidation, Odor control, *Wastewater treatment, Sludge conditioning.

The United States currently uses 20,000 tons per year of hydrogen peroxide for industrial or municipal wastewater and water treatment. Hydrogen peroxide is primarily a pretreatment agent, degrading many toxic materials (phenolics, refractory organics, cyanide, sulfur compounds, etc.) before the

biological oxidation step. It is also useful as a source of supplemental oxygen during spills, aerator outages, or excess organic loading, and as a sludge conditioner. Hydrogen sulfide can be controlled with hydrogen peroxide without the corrosion and toxicity problems common to carbon adsorption or chlorination. (Cassar-FRC)
W82-00345

**FINAL ENVIRONMENTAL IMPACT STATEMENT FOR WASTEWATER TREATMENT FACILITIES; CITY OF OLATHE, JOHNSON COUNTY, KANSAS.**
Environmental Protection Agency, Kansas City, MO. Region VII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-243131, Price codes: A21 in paper copy, A01 in microfiche.
Report EPA-907/9-81-002a, March, 1981. 484 p, 21 Fig, 27 Tab, 118 Ref, 7 Append.

Descriptors: *Environmental Impact Statement, *Olathe, Kansas, *Wastewater treatment, *Wastewater facilities, *Sewer systems, Environmental effects, Sewage districts, Economic aspects, Environmental protection.

This Final Environmental Impact Statement examined 11 alternatives for providing sewerage facilities for the Upper and Little Cedar Creek basins in and near the City of Olathe, Johnson County, Kansas. All alternatives were also intended to relieve existing overloading at Olathe's Harold Street treatment plant. Based on a comparative analysis of both monetary and nonmonetary impacts of the alternatives a preferred project has been selected. It consists of a 2 mgd wastewater treatment plant with a gravity interceptor, one major lift station, a force main and attached flow equalization basins. The gravity interceptor is generally aligned with Little Cedar Creek. The major lift station would pump around the east side of Ernie Miller Park. Recommendations are made for measures to reduce adverse effects of the project. The EPA intends to fund only a limited portion of the originally proposed project. (Brambley-SRC)
W82-00357

**FINAL ENVIRONMENTAL IMPACT STATEMENT; BEMIDJI WASTEWATER TREATMENT SYSTEM, BELTRAMI COUNTY, MINNESOTA.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, May, 1981. 144 p, 11 Fig, 17 Tab, 106 Ref, Append.

Descriptors: *Environmental Impact Statement, *Bemidji, Minnesota, *Wastewater treatment, *Wastewater facilities, Lakes, Eutrophication, Cost analysis, Water quality, Waste disposal, Land disposal, Social aspects, Tertiary wastewater treatment, Water pollution control, Phosphorus removal.

The effluent discharged from the wastewater treatment plant at Bemidji significantly affects the quality of the culturally and economically important lakes on the Upper Mississippi River downstream from the outfall sewer (Lakes Bemidji, Wolf, Andrusia, and Cass). A permanent solution to the wastewater disposal problem has been sought for more than 12 years, primarily because of the continued search for a means to eliminate a surface water discharge. Numerous land application search efforts have been conducted, and numerous geotechnical investigations and engineering reports have been completed during the past ten years. This Environmental Impact Statement addresses this long alternatives development process. At this time it appears that the only technically feasible, environmentally and socially acceptable, and cost-effective solution to the problem is the construction of a new tertiary wastewater treatment plant at the site of the existing plant in Bemidji with discharge to the Mississippi River channel to Lake Bemidji. It also appears that an effluent phosphorus concentration limitation of 0.3 mg/l (the most practical treatment) will protect Lake Bemidji from accelerated eutrophication and may contribute to improved water quality in the downstream Upper Mississippi River Chain of Lakes. (Brambley-SRC)
W82-00358

**FINAL ENVIRONMENTAL IMPACT STATEMENT; WASTEWATER TREATMENT FACILITIES, SOUTH SHORE LAKE TAHOE BASIN.**
Environmental Protection Agency, San Francisco, CA. Region IX.
Report, May, 1981. 217 p, 6 Fig, 15 Tab, 10 Ref.

Descriptors: *Environmental Impact Statement, *Lake Tahoe, California, *Wastewater treatment, *Wastewater facilities, Environmental effects, Social aspects, Secondary wastewater treatment, Irrigation water, Agriculture, Growth rates.

This Final Environmental Impact Statement on the wastewater treatment programs proposed by the South Tahoe Public Utility District and the Douglas County Sewer Improvement District No. 1, contains EPA's recommendations, and revisions and additions to the Draft Environmental Impact Statement. Based on the impact analysis of various growth scenarios and commitments to mitigate primary and secondary adverse impacts, EPA recommends for South Tahoe Public Utility District a 7.5 mgd maximum daily flow wastewater treatment plant which produces secondary treated and filtered effluent for agricultural irrigation in Alpine County, California. Possible plant expansion is contingent upon approval by various local and regulatory agencies and adequate performance under the mitigation program. The environmental parameters considered were water quality, biology, noise and air quality, and visual resources. The social parameters considered include land use, housing, transportation, recreation, public services/fiscal concerns, utilities, and cultural resources. The final environmental impact statement for Douglas County Sewer Improvement District No. 1 has been postponed because of lack of progress in developing a mitigation program. (Brambley-SRC)
W82-00359

**FINAL ENVIRONMENTAL IMPACT STATEMENT; REHABILITATION OF WASTEWATER FACILITIES, STREATOR, ILLINOIS.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, February 1981. 283 p, 11 Fig, 19 Tab, 101 Ref, 4 Append.

Descriptors: *Environmental Impact Statement, *Streator, *Illinois, *Wastewater treatment, *Wastewater facilities, Nitrification, Chlorination, Combined sewers, Effluents, Pit recharge, Water pollution control, Water quality, Pollution load, Leachates.

A Facilities Plan was developed for Streator, Illinois, which recommended substantial upgrading and expansion of the existing system, with separation of the existing combined sewer system, and treatment facilities which would reduce discharges to the Vermilion River. The Final Environmental Impact Statement proposes action on a reduced scale. The three major interceptor sewers in the combined sewer system would be replaced. The treatment plant would be upgraded to include nitrification and chlorination, to obtain effluent levels of 10 mg/l BOD5 and 12 mg/l suspended solids. Combined sewer flows in excess of the plant's capacity would receive primary treatment and chlorination prior to discharge to the river. The mines beneath Streator would be recharged with wastewater and stormwater to maintain present water levels. The proposed action would reduce substantially the pollutant loads to the Vermilion River, so water quality downstream should be improved, especially at low flow periods. Pollutant loads to the mines would be reduced, thus reducing leachate from them. Before any further action is taken it is necessary to determine the feasibility of the less stringent effluent levels, the recharge to the mines, and the sewer rehabilitation; the level of treatment under these conditions; and the most appropriate financing. (Brambley-SRC)
W82-00361

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 1: CRYSTAL LAKE AREA SEWAGE DISPOSAL AUTHORITY, BENZIE COUNTY, MICHIGAN.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, July 1980. 169 p, 7 Fig, 3 Tab, 7 Append.

Descriptors: *Environmental Impact Statement, *Crystal Lake, Michigan, *Wastewater facilities, *Wastewater treatment, *Water pollution control, Rural areas, Groundwater movement, Septic wastewater, Leachates, Pollution load, Phosphorus, Sewer systems, Case studies.

A Facilities Plan for the Crystal Lake area, which proposed a centralized collection and treatment system for the area, was followed by a Draft Environmental Impact Statement (DEIS), which recommended a Limited Action Alternative. Additional studies were conducted on groundwater flow patterns, septic leachate in Cold Creek, and aquatic productivity in effluent plumes and administrative procedures were clarified. The new studies generally confirmed the earlier ones. Groundwater flow patterns were clarified; under extreme conditions septic tank systems might contribute 6.7% of the lake phosphorus loads projected in the DEIS; and almost all of the dry-weather nutrient load was coming from a small tributary of Cold Creek. The recommended action is essentially that which was recommended in the DEIS, as follows: construction of connecting sewers and a new 0.33 mgd rotating biological contractor plant for Frankfort and Elberta; evaluation surveys and rehabilitation of their existing sewer systems; design and implementation of a small waste flow district for the remainder of the study area; site-specific environmental and engineering analyses of existing systems in the unsewered areas; repair and replacement of on-site systems as required; and cluster systems or other off-site treatment for portions of the shoreline. (Brambley-SRC)
W82-00362

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 2: THE GREEN LAKE SANITARY SEWER AND WASTE DISTRICT, KANDIYOHI COUNTY, MINNESOTA.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, December 1980. 165 p, 9 Fig, 6 Tab, 4 Append.

Descriptors: *Environmental Impact Statement, *Green Lake, Minnesota, *Wastewater treatment, *Wastewater facilities, *Sewer systems, Cost analysis, Water pollution sources, Groundwater, Water pollution control, Trophic level.

In response to a Facilities Plan for the Green Lake area which proposed a centralized wastewater collection and treatment system, the EPA prepared a Draft Environmental Impact Statement, which proposed alternatives. The centralized collection and treatment system is neither needed nor cost-effective, and the elimination of on-site wastewater system on the shorelines of Nest Lake and Green Lake will not change the trophic status of the lakes. Nonpoint sources are the larger source of nutrients to Nest Lake, and this load subsequently enters Green Lake. The wastewater treatment needs can be met by use of on-site systems, including new and upgraded systems, and by provision of decentralized off-site systems (cluster systems). To ensure reliability of these systems the sites must be chosen carefully; the natural assimilative capacity of local soil and groundwater resources must be considered; and adequate community supervision must be provided. Spicer and New London will continue to use their existing collection systems with final treatment facilities to be determined, while the shorelines of Nest and Green Lakes will continue to be served by on-site systems. (Brambley-SRC)
W82-00363

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 3; SPRINGVALE-BEAR CREEK SEWAGE DISPOSAL AUTHORITY, EMMET COUNTY, MICHIGAN.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, December 1980. 133 p, 6 Fig, 3 Tab, 9 Ref, 6 Append.

Descriptors: *Environmental Impact Statement, *Springvale - Bear Creek, Michigan, *Wastewater treatment, *Wastewater facilities, Water pollution control, Sewer systems, Septic tanks, Leachates, Eutrophication, Water quality.

Essentially the same action is recommended as in the Draft Statement, prepared in response to a Facilities Plan which called for a sewage collection system around Crooked Lake and Pickerel Lake with conveyance to a central wastewater treatment plant at Petoskey. There are localized shoreline water quality problems, so a Limited Action plan is recommended. The plan proposes the design and implementation of a small waste flows district; site-specific environmental and engineering analyses of existing on-site systems; repair and replacement of on-site systems as required; and cluster systems or other off-site treatment for Ellsworth Point and Botsford Landing. The site analyses should start with Ellsworth Point, Botsford Landing, and those individual systems that were found to be malfunctioning and a source of septic leachate plumes and high densities of Cladophora in the lakes. (Brambley-SRC)
W82-00364

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 4; STEUBEN LAKES REGIONAL WASTE DISTRICT, STEUBEN COUNTY, INDIANA.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, January 1981. 157 p, 5 Fig, 5 Tab, 7 Append.

Descriptors: *Environmental Impact Statement, *Steuben Lakes, Indiana, *Wastewater treatment, *Wastewater facilities, *Sewer systems, Septic tanks, Cost analysis, Water pollution sources, Leachates, Water quality, Population dynamics, Case studies.

A Facilities Plan proposed a centralized collection and treatment systems for the communities in the Steuben Lakes area. Because of the cost, the uncertainty of the water quality improvements, and the potential for induced growth, the EPA conducted studies for a Draft Environmental Impact Statement. These studies showed that a few on-site treatment systems were having an impact on water quality although many did not comply with the Steuben County Sanitary Code. A Limited Action Alternative was selected which included decentralized systems for the entire area, and a program to replace and rehabilitate on-lot systems. This alternative will constrain future population growth, and result in development patterns that are more scattered and at a lower density than that which could be accommodated by a centralized treatment plant. This alternative will not incur a severe financial burden on most of the residents. (Brambley-SRC)
W82-00365

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 5; OTTER TAIL COUNTY BOARD OF COMMISSIONERS, OTTER TAIL COUNTY, MINNESOTA.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, November 1980. 202 p, 8 Fig, 4 Tab, 8 Append.

Descriptors: *Environmental Impact Statement, *Otter Tail County, Minnesota, *Wastewater treatment, *Wastewater facilities, *Sewer systems, Septic tanks, Cesspools, Groundwater level, Groundwater pollution, Leachates, Water quality control, Water pollution sources, Coliforms, Case studies.

A Facilities Plan for centralized sewage collection and treatment for Otter Tail County, Minnesota, was rejected in the Draft Environmental Impact Statement (DEIS) because of its cost, uncertainty of water quality improvements, and potential for population growth. Subsequent groundwater hydrology and septic leachate surveys, and analyses of soils, groundwater and aquatic plants led to the Modified Limited Action Alternative. In this plan greywater/blackwater separation will only be used in individual dwellings where it will provide benefits; all cesspools will be replaced with on-site systems; holding tanks will be converted to receive only waste from very low flow toilets; all defective or undersized septic tanks will be replaced; dosed mound systems will be used where high groundwater prevents use of soil absorption systems; and half of the resort units will be served by cluster systems. This plan offers a low-cost solution to the wastewater problems of Otter Tail County - soil, lot size, and groundwater table conditions which make on-site treatment inadequate, high coliform counts in Otter Tail Lake, and high groundwater nitrate concentrations. (Brambley-SRC)
W82-00366

**STATE-OF-THE-ART OF LIQUID WASTE DISPOSAL FOR GEOTHERMAL ENERGY SYSTEMS: 1979,**
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5E.
W82-00375

**LIMESTONE-LIME TREATMENT OF ACID MINE DRAINAGE - FULL SCALE,**
Peabody Coal Co., St. Louis, MO.
D. G. McDonald, and A. F. Grandt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-172645, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S7-81-033, June 1981. 3 p, 1 Fig, 1 Tab.

Descriptors: *Acid mine drainage, *Wastewater treatment, *Chemical treatment, *Neutralization, *Lime, Limestone, Cost analysis, Sludge solids, Settleable solids, Sedimentation, Mine wastes.

A full-scale treatment plant was investigated to determine the most economical treatment of large volumes of highly acidic mine drainage and to characterize sludges from treatment processes as to settling behavior and solids content. Acid mine drainage was neutralized to pH 7.0 with a combination of limestone and hydrated lime, or with hydrated lime alone. The most economical treatment method was achieved through a combination of lime treatment on one line and limestone treatment on a second line, with recirculation on both lines. Both lime and lime-limestone treatment processes produced good settling behavior, with most of the sludges settling within one hour. Limestone treatment produced denser sludges with a higher solids content at pH levels above 4.5 than did the lime treatment. (Brambley-SRC)
W82-00377

**PHYSICAL/CHEMICAL TREATMENT OF BLAST FURNACE WASTEWATERS USING MOBILE PILOT UNITS,**
Rexnord, Inc., Milwaukee, WI.
R. Osantowski, A. Geinopolos, J. Kane, and G. Rollinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-159386, Price codes: A15 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-80-107, May 1981. 4 p, 3 Fig, 5 Ref.

Descriptors: *Wastewater treatment, *Pilot plants, *Steel industry, *Industrial wastes, Chlorination, Ozonation, Reverse osmosis, Cost analysis, Water quality, Standards, Effluents, Metals, Organic compounds, Blast furnace wastewater.

This project was initiated to provide an evaluation of the effectiveness of existing treatment technology for upgrading steel mill wastewaters to Best Available Technology (BAT) Economically Achievable limits for Blast Furnace Category scrubber wastewaters. The wastewater tested was a blast furnace effluent from an operating steel mill treatment system that met 1977 Effluent Guidelines for Best Practical Control Technology (BPT) Currently Available. This wastewater contained residual concentrations of suspended solids, BOD, oils and greases, phenols, cyanides, fluorides, ammonia compounds, sulfides, and dissolved solids. The in-depth pilot plant study was performed using mobile facilities designed especially for treating steel plant wastes. Treatment processes evaluated during the study included: alkaline chlorination, chemical treatment, dual media filtration, magnetic filtration, reverse osmosis, ozonation and activated carbon. Alkaline chlorination, ozonation, and reverse osmosis were all effective at reducing metals to $<10$ microgram/1 except for zinc and selenium, and organics to $<10$ microgram/1 with the exception of bis(2 ethylhexyl)phthalate. Alkaline chlorination was the least-cost alternative, whereas ozonation required least space. (Brambley-SRC)
W82-00378

**HIGH-LEVEL OZONE DISINFECTION OF MUNICIPAL WASTEWATER EFFLUENTS,**
Metcalf and Eddy, Inc., Boston, MA.
E. L. Stover, R. N. Jarnis, and J. P. Long.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-172272, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-040, May 1981. 8 p, 5 Fig, 1 Tab.

Descriptors: *Municipal wastewater, *Disinfection, *Wastewater treatment, *Ozonation, *Coliforms, Effluents, Water quality standards, Secondary wastewater, Design criteria, Sanitary engineering, Cost analysis, Filtered wastewater.

A 20-month operating experimental program conducted at Marlborough, Massachusetts, evaluated the feasibility, engineering, and economic aspects of achieving high-level effluent disinfection with ozone. The ozone research pilot facility had a maximum flow of 4.4 L/s (70 gpm), and was designed to operate with a constant wastewater flow rate or diurnal flow characteristic. Two effluent qualities (filtered nitrified and filtered secondary) were evaluated to assess water quality impacts on disinfection performance with ozone. The required absorbed ozone concentration to achieve specific levels of disinfection depended on water quality. Absorbed ozone concentrations of 15 to 20 mg/L and 35 to 40 mg/L were required to achieve high-level disinfection of less than 2.2 total coliforms/100 mL and 5 to 8 mg/L and 15 to 20 mg/L to achieve disinfection to 70 total coliforms/100 mL with the Marlborough filtered nitrified and filtered secondary effluent, respectively. Impacts of carrier gas ozone concentration, carrier gas flow rate, gas-to-liquid ratio, and applied ozone dose on contactor transfer efficiencies with both effluent qualities were defined. Water quality, transfer efficiency, and absorbed ozone concentrations are key factors affecting disinfection performance that must be evaluated for efficient design of ozone disinfection systems. Generator and contactor monitoring or mapping procedures and results using both air and oxygen carrier gases are presented as an approach for determining the economical ozone generator operating range and optimal ozone transfer efficiency. (Author's abstract)
W82-00379

**ASSESSMENT OF OIL SHALE RETORT WASTEWATER TREATMENT AND CONTROL TECHNOLOGY - PHASES I AND II,**
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 5B.
W82-00390

**JOINT DRY/WET WEATHER TREATMENT OF MUNICIPAL WASTEWATER AT CLATSKANIE, OREGON,**

Whiteley-Jacobsen and Associates, Portland, OR.
A. H. Benedict, and V. L. Roelfs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-187262, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-061, June 1981. 4 p, 3 Tab.

Descriptors: *Municipal wastewater, *Wastewater treatment, *Wastewater facilities, High flow, Low flow, Clarification, Activated sludge process, Dissolved air flotation, Effluents, Water quality, Cost analysis, Sewer systems, Capital costs.

The joint dry/wet weather wastewater treatment facility at the small community of Clatskanie, Oregon, underwent a 2-year evaluation. Wet weather flows (WWF), as much as 6 to 10 times dry weather flows, result from severe infiltration/inflow (I/I) to the collection system. Rather than undergo expensive sewer rehabilitation, the treatment facility was designed to process flows ranging from 0.13 to 1.25 mgd (490 to 4730 cu m/day) where average dry weather flow is 0.2 mgd. During dry weather, the plant operates up to 0.5 mgd with primary clarification and an activated sludge mode. For higher flows, the plant can be run in a contact-stabilization mode and the primary clarifier can be operated in a dissolved air flotation (DAF) mode. The waste activated sludge generated during dry weather operation is held as standby sludge for the contact-stabilization operation. Average TSS and BOD concentrations in the effluent of dry weather flows were 10 mg/l and 13 mg/l, respectively, and for WWF the respective concentrations were 2-39 mg/l and 6-20 mg/l. Operating criteria and performance capabilities were developed to assist in other potential applications. The capital cost of the DAF-contact stabilization capability was estimated to be 14% over the cost of a standard dry weather flow plant. The annual operation and maintenance cost was estimated to be 3% over the operation and maintenance cost of a standard dry weather flow plant. The results indicate that for other communities this treatment scheme may be more cost effective than extensive sewer rehabilitation provided the community is in the process of upgrading its treatment plant. For this approach to be a long-term solution to the I/I problem, however, the community must continue a sewer rehabilitation program, or an inflow control program, or both to keep pace with the growth of the city. (Brambley-SRC)
W82-00391

**RECLAIMING AND REUSING WASTEWATER,**
California Univ., Berkeley.
W. H. Bruvold, and J. Cook.
Water/Engineering and Management, Vol 128, No 4, p 65, 66, 68, 69, 71, April, 1981. 3 Tab, 11 Ref. OWRT-A-061-CAL(2).

Descriptors: *Reclaimed water, *Public opinion, Attitudes, Public health, Surveys, Wastewater treatment, Water treatment, Drinking water.

A study was performed to assess current public attitudes toward the use of reclaimed water for drinking, employing standard survey research procedures and a quantitative measure of attitudes. An assessment was then made of relations of the attitudes thus quantitated with sociodemographic and belief variables. The general recommendations resulting from the survey favored wastewater treatment and reuse comprising advanced waste treatment followed by beneficial reuse not involving a high degree of human contact. Public support for such proposals can be gathered in general by arguing that the public health is protected, that there is a need to conserve scarce water supplies, and that the environment will be protected from unnecessary degradation. Economic advantages of using reclaimed water could be of interest to the less affluent and more elderly population groups. Through such efforts the reuse of wastewater after treatment will gain support from the public, which is necessary if it is to be implemented. (Baker-FRC)
W82-00402

**HIGH PH TREATMENT OF COMBINED WATER SOFTENING AND WASTEWATER SLUDGES,**
Iowa Univ., Iowa City.
R. R. Dague, J. N. Veenstra, T. W. McKim, T. G. Ashenmacher, and J. M. Lannon.
Journal of the Water Pollution Control Federation, Vol 52, No 8, p 2204-2219, August, 1980. 24 Fig, 4 Tab, 32 Ref. OWRT-A-062-IA(1).

Descriptors: *Lime, *Bacteria, *Hydrogen ion concentration, *Disinfection, Sludge treatment, *Wastewater treatment, Coliforms, Water treatment, Activated sludge, *Water softening.

Water softening sludge combined with waste water sludge was studied in a 2-phase investigation of the effects of high pH on bacterial survival. From 99.44 to 99.98% of fecal coliforms in waste water sludge alone were killed at pH values between 11.0 and 12.2 at 20C and 35C after 1 hour. Total aerobes were slightly hardier--under the same conditions 98.58-99.87% were killed. Fecal streptococci were even more resistant: 93-96% died after 1 hour at pH 12.2, temperature 20C and 35C, and more survived at lower pH. Grow-back occurred at 20C and 35C, especially in fecal coliforms. After 48 hours, these bacterial counts exceeded baseline counts at all pH tested (5.8-12.2) except for pH 11.8 and 12.2 at 20C. Total aerobes showed slight grow-back at pH 11.8 from the 1 hour kill levels, increasing as pH decreased from that point. Fecal coliforms had the least tendency to grow back, showing larger than baseline counts only at pH 5.8. Adding chemical water softening sludges to primary waste water sludge somewhat reduced the amount of hydrated lime required to reach and maintain a pH of 12.0 for 15 days. The chemical quality of the combined sludge improved vacuum filter dewatering performance in terms of total cake solids and filter yields. However, when applied to mixtures of waste activated sludge and primary waste water sludge, high pH treatment increased COD, BOD, and total Kjeldahl nitrogen in filtrates from dewatering operations and produced no reduction in lime requirements. (Cassar-FRC)
W82-00403

**DESIGN, EVALUATION AND EFFLUENT WATER QUALITY ANALYSIS OF THREE OYSTER SHELLSTOCK WASHERS,**
Mitre Corp., McLean, VA.
S. S. Chang, and F. W. Wheaton.
Transactions of the ASAE, Vol 24, No 1, p 234-241, January-February, 1981. 4 Fig, 4 Tab, 17 Ref. OWRT-A-033-MD(2).

Descriptors: *Oysters, *Waste water treatment, *Food-processing wastes, Water quality control, Biochemical oxygen demand, Chemical oxygen demand, Waste water analysis, Hydrogen ion concentration, Water quality standards, Maryland, Industrial waste water, Disinfection.

Due to pressure from the Food and Drug Administration and state health officials, the washing of oyster shellstock in Maryland is becoming a more common practice in the oyster industries. Three techniques of washing oyster shellstock were evaluated for their effectiveness of cleansing oysters. The two methods giving the best cleaning results were examined for wash water quality to determine the need for waste water treatment in oyster processing plants. A rotary tumbler, a rotary brush washer, and a pressurized water spray washer were designed and constructed. Methods which gave the best results were examined for fifteen water quality parameters. Results of the water quality analysis showed that the effluent must be disinfected prior to discharge. It was also found that in some cases, the effluent pH should be lowered to comply with existing EPA standards and regulations set down by the state of Maryland. The practice of washing oyster shellstock will add biochemical oxygen demand, chemical oxygen demand, bacteria, suspended solids, filterable solids and settleable solids to the waste water of oyster processing plants. (Geiger-FRC)
W82-00406

**CONTINUOUS BIOREGENERATION OF GRANULAR ACTIVATED CARBON DURING THE ANAEROBIC DEGRADATION OF CATECHOL,**
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
M. T. Suidan, W. H. Cross, and M. Fong.
Progress in Water Technology, Vol 12, No 6, p Tor 203-214, 1980. 5 Fig, 4 Tab, 13 Ref. OWRT-A-077-GA(2).

Descriptors: *Activated carbon, *Tertiary treatment, *Filters, *Waste water treatment, Organic wastes, Industrial wastes, Adsorption, Separation techniques, Methane, Chemical oxygen demand, Biodegradation, Biological treatment, Aromatic compounds, Anaerobic conditions.

An anaerobic activated carbon filter consisting of four jacket columns and three clarifiers was used to treat a synthetic waste water containing catechols. Catechol was removed from the feed solution mainly by adsorption onto the activated carbon during the initial acclimatization period. Following acclimatization, vigorous anaerobic activity took place, which generated a greater total carbon equivalent in the gaseous products than was removed as organic carbon during anaerobic bioregeneration of the activated carbon. When the period of vigorous anaerobic activity was finished, the production of gas returned to a level corresponding to the amount of organic carbon removed during the treatment process. Steady-state operating conditions were found at all three feed concentrations of catechol tested, which corresponded to 200, 400, and 1,000 milligrams/liter. With the present device, total organic carbon reductions exceeded 81%, while chemical oxygen demand removals of 95% were achieved. (Geiger-FRC)
W82-00408

**PROCESSING NEEDS AND METHODOLOGY FOR WASTEWATERS FROM THE CONVERSION OF COAL, OIL SHALE AND BIOMASS TO SYNFUELS.**
California Univ., Berkeley. Dept. of Chemical Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV-0081, Price codes: A09 in paper copy, A01 in microfiche. Department of Energy Report DOE/EV-0081, May 1980. 185 p, 1 Fig, 3 Tab, 17 Ref, 15 Append. DE-AT03-79EV10227.

Descriptors: *Process water, *Wastewater treatment, *Oil shale, *Coal gasification, *Biomass, Fuel, Industrial wastes, Water use, Water reuse, Pollution load, Pollutants, Effluents, Water pollution control, Sludge disposal, Water conservation.

This report stems from the workshop held at Germantown, Maryland, 14-15 June 1979, with the purpose of identifying needs to be accomplished by processing technology and evaluating the suitability, approximate costs and problems associated with wastewaters from the conversion of coal, oil shale and biomass to synfuels. Water usage may be very high, but can be reduced by recycling within the plant. Some possible effluent levels from pollutants are suggested. Costs are presented for gravity separation techniques, steam stripping, solvent extraction, bio-treatment, carbon adsorption, iron precipitation, ozonation, wet-air oxidation, ion exchange, incineration, deep-well injection, and concentration processes, with their technical advantages and disadvantages. The critical environmental control issues are identified as total dissolved solids, polynuclear aromatic hydrocarbons and nitrogen heterocyclics, ammonia or nitrate, color, arsenic and other heavy metals, boron, toxicity safeguard, disposal of sludges, carbon regeneration effluent, and secondary effluent. Water handling and treatment should be considered as an integral part of a specific fuel conversion process, and the possibilities of recycling and reuse explored to reduce water demand. Each appendix is an individual status report on wastewater processing and methodology. (See W82-00432 thru W82-00445) (Brambley-SRC)
W82-00431

**ASSESSMENT OF ENVIRONMENTAL CONTROL TECHNOLOGY FOR COAL CONVERSION PROCESSES,**
Oak Ridge National Lab., TN.
J. A. Klein.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV-0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p B1-B6, 1 Fig, 3 Ref.

Descriptors: *Coal, *Wastewater treatment, *Coal gasification, *Biodegradation, *Adsorption, *Ozonation, Bacteria, Organic compounds, Phenols, Hydrocarbons, Industrial wastes.

The effectiveness of various treatment systems for the cleanup of aqueous coal conversion wastes is being investigated. A flow sheet of a number of waste treatment units was developed, and three have been investigated as independent units. A tapered fluidized-bed bioreactor containing bacteria on a support of coal or sand has been used with and without oxygen. The bioreactor can reduce phenol to < or = 1 microgram/cu cm, thiocyanate to 1-5 microgram/cu cm and total soluble organics by 95%. Adsorption experiments have attempted to find a substitute for activated charcoal, and a Texas lignitic coal was found to reduce 90% of the polynuclear aromatic hydrocarbons (PAH) and 9% of the total organic carbon content of a hydrocarbonization water. Ozonation has been investigated as a final cleanup step, to remove those compounds which pass through biological treatment. Ozonation can reduce PAH and phenol levels by 95-98%, with contact times of 15 min or less. The most effective integration of these units with others has yet to be achieved. (See also W82-00431) (Brambley-SRC)
W82-00432

**SLAGGING FIXED-BED GASIFIER (SFBG) WASTEWATER PRETREATMENT,**
Department of Energy, Grand Forks, ND. Grand Forks Energy Technology Center.
W. G. Willson.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV-0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p C1-C4.

Descriptors: *Coal gasification, *Wastewater treatment, *Industrial wastewater, *Waste characteristics, Effluents, Zero discharge, Waste disposal, Economic aspects, Environmental effects.

The Grand Forks Energy Technology Center's 24-ton/day slagging fixed-bed gasifier (SFBG) is the only operable unit of its type in the United States, and affords many research opportunities in the coal gasification process. Commercially available waste water treatment processes appear to be applicable to coal gasification waste streams, but each treatment plant will need appropriately designed units to meet the specific technology and feedstock requirements and the environmental and economic constraints at each particular installation. The SFBG can be used with low-rank and bituminous coals to develop such specific information, and by sampling and analysis of waste streams to characterize gaseous, solid, and liquid effluents, and by testing of treatment processes, may establish the feasibility of zero discharge of liquids and safe disposal of solid wastes. The economics of the treatment processes must also be determined. (See also W82-00431) (Brambley-SRC)
W82-00433

**TREATMENT OF COAL GASIFICATION PROCESS WASTEWATERS,**
Carnegie - Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
R. C. Luthy.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p D1-D9, 2 Fig, 11 Ref.

Descriptors: *Coal gasification, *Process water, *Wastewater treatment, *Biological wastewater treatment, Effluents, Nitrification, Adsorption, Reverse osmosis, Ion exchange, Cyanide, Ammonia, Phenols, Economic aspects, Hydrocarbons, Chemical oxygen demand.

Biological treatment, alone or with physicochemical treatment is an important method of upgrading coal gasification wastewaters. Studies have been conducted using two different wastewaters and different dilutions to determine removal efficiencies and cell residence times. Nitrification was feasible with the slagging fixed-bed pilot plant effluent, but not with the Hygas pilot plant effluent. Nitrification efficiency with stripped wastewater was greatest at low COD removal rates. Up to 100 mg/l cyanide could be treated without difficulty. Both wastewaters required dilution or ammonia stripping to overcome ammonia toxicity. Phenol recovery by solvent extraction is believed to be technically feasible but economically uncertain. Ultimately the need to protect the biological reactor from shock organic loads and to remove refractory organic compounds may outweigh economic considerations. Ion exchange studies have shown good breakthrough characteristics and capacities for biological reactor effluent which had been pretreated by activated carbon adsorption for residual organic removal. Reverse osmosis was not as effective, and the membrane characteristics deteriorated rapidly. Powdered activated carbon tratment provided greater removal of COD and polynuclear aromatic hydrocarbons. (See also W82-00431) (Brambley-SRC)
W82-00434

**ENVIRONMENTAL CONTROL TECHNOLOGY FOR THE FLASH HYDROPYROLYSIS OF COAL,**
Brookhaven National Lab., Upton, NY. Process Sciences Div.
A. S. Albanese.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV-0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p E1-E7, 3 Ref.

Descriptors: *Coal gasification, *Water pollution sources, *Wastewater treatment, *Process water, Biological wastewater treatment, Filtration, Phenols, Ammonia, Suspended solids, Fluorides, Organic compounds, Runoff, Leachates.

The environmental factors and control technologies involved in the flash hydropyrolysis of coal for the production of gaseous and liquid hydrocarbon fuels and feedstocks are assessed. An aqueous phase is produced in the process which contains ammonia, phenols, cyanide and thiocyanate in proportions depending upon the original coal and the hydropyrolysis conditions. Facilities to treat these liquid wastes include a degasifier and condensate cooler, phenol remover, biological treatment reactor, and final wastewater treatment unit. Filtration to remove suspended solids and lime treatment to remove fluoride ions may also be required. Phenols can be removed by solvent extraction using isopropyl ether or oil. Biological treatment can be used to remove nitrogen, phosphorus and sulfur compounds and some organics, but not aromatic hydrocarbons or trace metals. Additional water pollution problems may arise from run-off from the coal before processing, and the leachate from disposal of the coal refuse. (See also W82-00431) (Brambley-SRC)
W82-00435

**CHEMICAL RECOVERY FROM COAL CONVERSION WASTES BY CONCENTRATION,**
Concentration Specialists, Inc., Andover, MA.
W. R. Killilea.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p F1-F6, 2 Fig.

Descriptors: *Coal gasification, *Wastewater treatment, *Wastewater renovation, *Water reuse, *Chemical recovery, Phenol, Ammonia, Freeze crystallization, Incineration, Cost analysis, Cooling water, Waste disposal.

A study was conducted to determine the feasibility of using concentration processes to recover chemical by-products from the gas liquor stream of a coal gasification plant and to produce reusable water. Large quantities of gas liquor are produced containing high concentrations of phenol and ammonia. Reverse osmosis and evaporation were investigated and rejected whereas freeze crystallization was practical and economically cost-effective. A three-stage freezing system was designed, in which pure water freezes first and is removed; continued cooling results in the precipitation of ammonium carbonate, and then of phenol. Each solid product is washed to remove surface contamination and the wash water returned to the gas liquor feed. The water obtained from the melted ice can be used as cooling tower water with some make-up water, and the remaining heavily contaminated water can be disposed of by chemical fixation, incineration, or return to the gasifier. Based on current, available costs, with the three-stage freezing process and incineration of the waste concentrate, a return of 80 cents/1000 gallons can be achieved. (See also W82-00431) (Brambley-SRC)
W82-00436

**IMPROVED WATER MANAGEMENT OF COAL CONVERSION PROCESSES BY PRELIMINARY ABSORPTION OF HALIDES,**
McKee (Arthur G.) and Co., Cleveland, OH.
W. A. Parsons.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p G1-G5.

Descriptors: *Coal gasification, *Wastewater treatment, *Halogens, *Condensates, Dissolved solids, Cost analysis, Incineration, Evaporation, Waste disposal, Desalination, Desalination wastes, Reverse osmosis.

The technical, economic and environmental advantages and disadvantages of single stage and two stage gas quenching at a producer gas installation were compared. Air-blown and oxygen-blown gasifier operations were used with a high halide Illinois coal and a low halide Montana coal. A first stage quench condensing 10 gallons of water/ton of coal by either a sieve tray absorber or a venturi scrubber was determined to be effective for absorption of halides. The secondary condensate was amenable to recovery as a low dissolved solids service water after processing by steam stripping and activated sludge treatment. The two stage quench system was cost effective with the Illinois coal whereas the single quench system was cost effective for the Montana coal. The dominant variable in determining the cost effectiveness was the halide content. For halide concentrations, expressed as chloride, above 0.15% and 0.16%, for air-blown and oxygen-blown gasifier operations, respectively, the two stage system is cost effective, while for lower halide concentrations the single quench system is cost effective. The preferred disposal concept for inorganic wastewater blown down from a high halide coal operation was incineration with disposal of salt cake at sea, using a two stage quench system in conjunction with desalination by reverse osmosis and thermal evapora-

tion. When low halide coal is used the preferred disposal concept was pond evaporation, using a single quench system in conjunction with desalination by reverse osmosis. (See also W82-00431) (Brambley-SRC)
W82-00437

**SOLVENT EXTRACTION OF PHENOLS,**
California Univ., Berkeley.
C. J. King, S. Lynn, D. N. Hanson, D. C. Greminger, and G. P. Burns.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewater from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p H1-H8, 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Coal gasification, *Wastewater treatment, *Phenols, *Organic solvents, Solubility coefficient, Waste recovery, Molecular structure, Temperature, Hydrogen ion concentration, Diisopropyl ether, Methyl isobutyl kentone.

The Lurgi Phenosolvan process for solvent extraction from coke-oven waters using diisopropyl ether as the solvent has been suggested as a method of phenol removal from coal-conversion plant wastewaters. This may not be possible because of the significant quantities of polyhydric phenols in the coal-conversion wastewaters, and the high pH of the wastewater, and because of the need to simplify the Phenosolvan process and to determine the most appropriate temperature for the process. The presence of a carbonyl group increases hydrogen bonding with the hydroxy groups of the phenols, so based on its miscibility, volatility and stability properties methyl isobutyl ketone (MIBK) was selected as a test solvent. The distribution coefficients for 6 polyhydric phenols into MIBK were determined. The values obtained showed that MIBK extraction could be practical. The distribution coefficient for phenol into MIBK decreased with increasing temperature, suggesting that the extraction process could be carried out at low temperatures, which could favor vacuum stripping. For both phenol and resorcinol the distribution coefficient in diisopropyl ether decreases with increasing pH, and is significantly reduced in the pH range of coal-conversion wastewaters, whereas the distribution coefficient for phenols into MIBK is significantly higher at low pH. (See also W82-00431) (Brambley-SRC)
W82-00438

**ASSESSMENT OF SOLVENT EXTRACTION FOR TREATMENT OF COAL GASIFIER WASTEWATER,**
Missouri Univ.-Columbia.
R. H. Luecke.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV-0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p I1-18, 3 Tab, 8 Ref.

Descriptors: *Coal gasification, *Wastewater treatment, *Phenols, *Organic solvents, Pollutants, Capital costs, Operating costs, Cost analysis, Waste recovery, Octanone, Economies of scale.

Solvent extraction of organic pollutants from coal gasification plant waste streams may overcome some of the problems associated with other methods. To make the process efficient a dual extraction process is recommended, in which the wastewater is contacted counter-currently with a polar solvent and then in another contactor with a non-polar solvent. The solvent streams are processed in separate distillation systems, with the pollutants being recovered and the solvents recycled to appropriate extraction. A design for an extraction system using 2-octanone has five stages, which will remove hydroquinone at 75% efficiency, catechol at 95%, resorcinol at 99%, and phenol, cresols and xylenols at 99.99% efficiencies. The process is relatively complex and hence expensive. The capital investment for a plant to treat 100 gpm of wastewater is about $0.5 million, and for a 1000 gpm plant is $1.7 million. Operating costs range up to $6.50/1000 gallons, compared to about $0.40/1000 gallons for biological treatment, indicating that a sizeable return on the recovered pollutants is necessary to justify the solvent extraction wastewater treatment process. (See also W82-00431) (Brambley-SRC)
W82-00439

**CONTROL TECHNOLOGY STRATEGIES FOR COAL PREPARATION WASTE DRAINAGES,**
Los Alamos Scientific Lab., NM.
P. Wagner, J. M. Williams, J. P. Bertino, L. E. Wangen, and P. L. Wanek.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p J1-J8, 5 Tab.

Descriptors: *Wastewater treatment, *Mine wastes, *Water pollution control, *Acid streams, Coal mining, Calcining, Wastedisposal, Bases, Chemical reactions, Leachates, Dissolved solids, Hydrogen ion concentration, Trace elements, Cost analysis.

Laboratory investigations were conducted into the options available for treating high-sulfur coal refuse materials by calcining to immobilize refuse constituents, codisposal of wastes with alkaline materials, and by treating the contaminated drainage from refuse dumps. A high-sulfur coal preparation waste was calcined at temperatures up to 1200C for 2h. Mineral conversion reactions took place which resulted in reductions of up to two orders of magnitude of toxic elements in the leachate. Addition of 3 and 10% by weight of lime to the same coal waste with subsequent drying and recrushing effectively reduced the acidity of leachates, and lowered the total dissolved solids and the trace element concentrations. Smaller lime additions were not effective. Contaminated refuse drainages from three plants were titrated with limestone, lime or sodium hydroxide to a predetermined pH. Raising the pH was associated with a reduction of total dissolved solids. All the methods are effective in reducing or abating trace element contamination of coal refuse drainage, but they differ significantly in cost, process complexity, treatment duration, by-products potential, permanency, and categorization of the waste for Resource Conservation and Recovery Act purposes. (See also W82-00431) (Brambley-SRC)
W82-00440

**CHARACTERIZATION AND PROCESSING OF COAL CONVERSION PROCESS WASTEWATERS,**
Department of Energy, Pittsburgh, PA. Pittsburgh Energy Technology Center.
G. E. Johnson, and C. J. Drummond.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p K1-K14, 8 Fig, 2 Tab.

Descriptors: *Coal gasification, *Wastewater treatment, *Process water, Water pollution control, Phenols, Ammonia, Hydrocarbons, Oil, Activated carbon, Adsorption, Nitrification, Chemical precipitation, Biochemical oxygen demand, Oxidation.

A commercial coal gasification plant is expected to produce about 3 mgd of process waters containing phenols, ammonia, polynuclear aromatic hydrocarbons, and other pollutants, which must be treated. The Synthane process produces a byproduct char which has been partially activated, and has the properties of a low grade activated carbon. It can be used as an adsorbent for Synthane process condensates, either as a primary treatment step or as a tertiary polishing step following biochemical oxidation. The other units of the treatment system are nitrification, and oil and tar precipitation. Ammonia is removed to about 500 mg/l by batch stripping with nitrogen at 90C. Oils and tars are precipitated by acidification to pH 2.5 with phosphoric acid, followed by lime neutralization. A complete mix, continuous unit with sludge recycle has been produced for biochemical oxidation. The separate units have been integrated to produce a treatment sequence with a flow capacity of 6 gal/h. (See also W82-00431) (Brambley-SRC)
W82-00441

**BIOLOGICAL OXIDATION OF AQUEOUS THIOCYANATE,**
Pittsburgh Univ., PA. Dept. of Civil Engineering.
R. D. Neufeld, L. Mattson, and P. Lubon.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p L1-L10, 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Coal gasification, *Wastewater treatment, *Thiocyanates, *Biological oxidation, Effluents, Pollution load, Kinetics, Sludge volume index, Pilot plants, Steel industry, Industrial wastes.

Depending on the coal and the gasification conditions, coal gasification produces effluents containing 35-1250 mg/l of thiocyanate. Research has been conducted to develop a kinetic expression and material balance for nitrogen and sulfur for the biological oxidation of aqueous thiocyanates as found in coal conversion and steel industry wastewaters. Biochemical degradation of thiocyanate yields sulfate, sulfide, and ammonium ions. Experiments were conducted in fill and draw semi-continuous reactors with 3.5 or 8 1 working volumes, sludge age of 5-15 days, pH of 7 or 8, and an organism which used thiocyanate as the sole carbon source. Specific utilization of thiocyanate increases with substrate concentration up to about 550 mg/l, when it becomes inhibitory. A representative yield coefficient for thiocyanate degrading organisms was about 0.127 lb volatile suspended solids/lb thiocyanate. The biooxidation process seems to be unstable at sludge ages of less than four days. In this system 89-106% of the thiocyanate nitrogen was accounted for as ammonia, and 90-97% of the thiocyanate sulfur was accounted for as sulfate. Sludge settling rates and volume are considered good, and should pose no problems in clarification processes. (See also W82-00431) (Brambly-SRC)
W82-00442

**WATER-RELATED ENVIRONMENTAL CONTROL REQUIREMENTS OF WASTE-TO-ENERGY CONVERSION,**
Iowa State Univ., Ames.
J. C. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p M1-M5, 2 Tab.

Descriptors: *Wastewater treatment, *Water pollution control, *Water pollution prevention, *Fuel, Wastewater analysis, Water quality standards, Pollutants, Solid waste disposal, Biomass, Anaerobic digestion, Biological wastewater treatment, Leachates.

Laboratory-scale tests have been conducted with wastewaters from four waste-to-energy conversion processes to determine their treatability by conventional and advanced technology, their impact on biological treatment systems, and the leaching characteristics of their solid residues and sludges. Problems common to all the processes are the lack

of dependable test methods for analyzing wastewaters for priority pollutants and other constituents, the lack of definite discharge standards for priority pollutants, and uncertainty over methods of solid residue disposal. Specific water related pollution technologies have been identified for each waste-to-energy conversion process. Physical and/or chemical treatment is suitable for controlling the inorganic compounds resulting from mass-burning. Dry processing of refuse derived fuel produces wastes which can be discharged to municipal sewers, if the ash sluice waters are recycled. The wastes from wet processing facilities can be treated by biological and chemical methods. Pyrolysis processes produce priority pollutants which may be treated by biological or chemical methods, but may not achieve reduction to permissible discharge levels. Priority pollutants from anaerobic digestion processes tend to be adsorbed to the residual solids, posing the problem of leachate from the ultimate disposal site. Biological or chemical methods can be used to treat the wastewater. (See also W82-00431) (Brambley-SRC)
W82-00443

**ENVIRONMENTAL CONTROL TECHNOLOGY FOR SHALE OIL WASTEWATERS,**
Battelle Pacific Northwest Lab. Richland, WA.
B. W. Mercer.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p N1-N14, 3 Fig, 5 Tab.

Descriptors: *Oil shale, *Wastewater treatment, *Water pollution control, *Pollution load, Ammonia, Organic compounds, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Heavy metals, Cost analysis, Water reuse.

Studies have been conducted to assess current technology for the treatment and disposal of shale oil wastewaters to maintain acceptable quality levels in the receiving waters of the oil shale regions presently under development. The wastewaters are highly contaminated with ammonia, BOD, refractory organics, and salinity, a stable suspension of organic matter, and with toxicants such as arsenic which may interfere with biological treatment. Treatment by a series of units is necessary to obtain satisfactory reduction of pollutants. Raw retort water treated by suspended matter removal, ammonia removal, BOD removal, suspended solids removal, dissolved organics removal, and dissolved salts removal is of a quality suitable for discharge or reuse. Ammonia was removed by steam stripping; activated sludge and activated carbon were used to remove BOD and COD, respectively. Costs for the treatment range from $26-45.00/1000 gal. The water can be reused for steam generation or cooling purposes. (See also W82-00431) (Brambley-SRC)
W82-00444

**POTENTIAL USES OF SPENT SHALE IN THE TREATMENT OF OIL SHALE RETORT WATERS,**
California Univ., Berkeley. Lawrence Berkeley Lab.
J. P. Fox, and D. L. Jackson.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV-0081, Price codes: A09 in paper copy, A01 in microfiche. In: Processing Needs and Methodology for Wastewaters from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Department of Energy Report DOE/EV-0081, May 1980. p 01-020, 5 Fig, 6 Tab, 8 Ref.

Descriptors: *Oil shale, *Wastewater treatment, *Organic carbon, *Adsorption, Specific conductivity, Hydrogen ion concentration, Inorganic carbon, Odor control, Color removal, Water pollution control.

Spent shale has two potential applications in wastewater purification - circulation of water through a spent in situ retort, and circulation of water through columns packed with spent shale from surface retorts. Batch and column studies were conducted with four samples of retort water and six of spent shale to determine the effects on dissolved organic carbon (DOC), dissolved inorganic carbon (DIC), conductivity and pH. In the batch studies reductions in DOC of up to 73% were achieved and up to 99% of DIC. Spent shales with the highest DOC adsorptive capacity are least effective in DIC removal and vice versa. The reduction in DIC levels is accompanied by a decrease in conductivity and an elevation in pH. In the column experiments the color and odor of retort water was almost completely removed by the spent shale, and some organic compounds were removed, but column breakthrough occurred before two pore volumes could be treated. If this problem is overcome, passage through spent shale could become a useful treatment process. It makes ammonia stripping easier by increasing the pH, and by reducing DIC, DOC and conductivity, it decreases the load on these treatment units. (See also W82-00431) (Brambley-SRC)
W82-00445

**THE HARVEST OF MICROALGAE FROM THE EFFLUENT OF A SEWAGE FED HIGH RATE STABILIZATION POND BY TILAPIA NILOTICA. PART 1: DESCRIPTION OF THE SYSTEM AND THE STUDY OF THE HIGH RATE POND,**
Asian Inst. of Tech., Bangkok (Thailand). Div. of Agricultural and Food Engineering.
P. Edwards, and O-A. Sinchumpasak.
Aquaculture, Vol 23, No 1-4, p 83-105, April, 1981. 4 Fig, 3 Tab, 27 Ref.

Descriptors: *Stabilization ponds, *Wastewater treatment, *Phytoplankton, Algae, Experimental design, Design criteria, High flow, Growth.

A sewage-driven, two trophic level food chain involving phytoplankton produced in a high rate stabilization pond and herbivorous Tilapia nilotica raised in associated fish ponds was studied to determine factors affecting fish growth and to assess the fertilization potential of the fish pond effluent for maize cultivation. The waste treatment and recycling system consisted of a 200-square-meter high rate stabilization pond, a series of 4-cubic-meter concrete fish ponds, and a maize plot. The sewage fed to the stabilization pond was weak, with a mean 5-day biological oxygen demand of 45 mg per liter and a mean surface organic loading of 75 kg of 5 day biological oxygen demand per hectare per day. As a result, the pond was nutrient limited, not light-limited. The mean phytoplankton concentration was 94 milligrams per liter, with a detention time of 3 days, and the mean phytoplankton yield was 15.7 grams per square meter per day. It should be possible to achieve at least double this yield in a high rate stabilization pond in Thailand without nutrient limitation. The wide variety of dominant phytoplankton recorded in the high rate stabilization pond may have been due either to the weak sewage or to the lack of seasonal temperature changes. Although the phytoplankton community was generally stable, it collapsed on two occasions. There were no discernible seasonal variations in the composition of the phytoplankton community. (Carroll-FRC)
W82-00455

**MANAGEMENT AND DESIGN IMPLICATIONS OF A MATHEMATICAL MODEL OF A RAPID GRAVITY SAND FILTER BACKWASH,**
Rodbourne Water Pollution Control Plant, Swindon (England).
J. Hilton, and K. V. Whitehall.
Water Research, Vol 15, No 8, p 1013-1017, August, 1981. 3 Fig, 2 Ref.

Descriptors: *Mathematical models, *Backwash, *Gravity filters, Sand filters, Filtration, *Wastewater treatment, Water treatment, Design criteria.

A model of the hydraulic system of backwashing was developed and tested. The model assumes that above the media surface the direction of flow is horizontal towards the weir, that below the media surface flow is vertical, and that the two are instantaneous. The model is applied to the problem of sand loss in rapid gravity filters. This theory suggests a new remedy involving the reduction of the bed length. Also, it suggests the use of closely spaced longitudinal weirs. The model is also applied to investigate backwash times. An equation is presented to determine the minimum length of backwash required to obtain an acceptably clean bed. The model can determine the length of backwash necessary in order to obtain maximum removal of solids with minimum use of backwash water. (Small-FRC)
W82-00460

**LOW TEMPERATURE REMOVAL OF NITRATE BY BACTERIAL DENITRIFICATION,**
Trondheim Univ. (Norway).
G. Halmo, and K. Eimhjellen.
Water Research, Vol 15, No 8, p 989-998, August, 1981. 4 Fig, 7 Tab, 14 Ref.

Descriptors: *Denitrification, *Activated sludge process, *Bacteria, *Wastewater treatment, Biological treatment, Nitrates, Nitrification, Domestic wastes, Temperature effects.

Enrichments of psychrophilic denitrifying bacteria were tested to further understand the problems associated with low-temperature denitrification in wastewater treatment. Two denitrifying sludges enriched at 5 and 20 deg C were exposed to the same chemical and hydraulic conditions, and sludge efficiency was determined. In the range 0-17 deg C, the specific denitrification rate of the low temperature sludge was 1.5-4 times the high temperature sludge rate. Also, at 2 deg C under nitrate limiting conditions, 98% nitrate reduction was found at a hydraulic resistance time of 3.5 hr with an influent concentration of 0.8 mg N03-N per liter. Low temperature sludge also had better sedimentation characteristics. The low temperature sludge consisted predominantly of psychrotrophs/psychrophiles and had low concentrations of mesophiles. Low temperature sludges tested in a three stage biological process receiving domestic sewage gave 90% removal of total nitrogen at hydraulic residence times of 1.5, 9, and 4 hr for two aeration stages and an anaerobic stage, respectively. Overall nitrification/denitrification was 95%. (Small-FRC)
W82-00461

**TESTING THE FLOCCULATION/COAGULATION OF WASTEWATER BY GRANULOMETRIC ANALYSIS OF SUSPENDED SOLIDS IN THE WATER USING A LASER DIFFRACTION METER,**
Centre de Recherche de l'Omnium d'Assainissement, Colombes (France).
C. Casellas-Salha, F. Acobas, J. Bontoux, and H. Moreaud.
Water Research, Vol 15, No 8, p 969-975, August, 1981. 12 Fig, 1 Tab, 20 Ref.

Descriptors: *Flocculation, *Suspended solids, Measuring instruments, *Lasers, *Wastewater treatment, Performance evaluation, Coagulation.

The optimization and control of the flocculation/coagulation process were investigated, and a parameter which expresses the efficiency of flocculation was defined and measured. A granulometric analysis of the suspended solids in the flocculated supernatant revealed that the concentration of particles between 1.5 and 10 micrograms could be a satisfactory control parameter. A laser diffraction meter is capable of making this measurement and has the necessary sensitiveness, reliability, short response time, and ease of automation. The instrument was calibrated by measuring suspended solids remaining in supernatants using water of various qualities. The unit can be used for continuously controlling the quality of the effluent from a physical/chemical wastewater treatment plant. Also, it could be used to determine the quality of raw water for a water treatment facility. (Small-FRC)
W82-00463

**DEEP WELL INJECTION OF INDUSTRIAL WASTES,**

For primary bibliographic entry see Field 5E.
W82-00475

**RESPONSE OF BACTERIA IN WASTEWATER SLUDGE TO MOISTURE LOSS BY EVAPORATION AND EFFECT OF MOISTURE CONTENT ON BACTERIAL INACTIVATION BY IONIZING RADIATION,**
Sandia National Lab., Albuquerque, NM.
R. L. Ward, J. G. Yeager, and C. S. Ashley.
Applied and Environmental Microbiology, Vol 41, No 5, p 1123-1127, May, 1981. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Sludge, *Moisture content, *Enteric bacteria, *Wastewater treatment, *Bacteria, Sewage bacteria, Liquid sludge, Survival, Population density, Population dynamics, Sludge drying, Ionization, Gamma radiation, Irradiation.

The potential use of sand-bed drying for inactivation of sludge pathogens and subsequent use of ionizing radiation to further disinfect dried sludges raises questions concerning the separate and combined effects of the drying process and ionizing radiation on the survival of enteric bacteria. The survival of six fecally-associated bacteria grown separately in sterilized sludge and of bacteria indigenous to sludge was examined following sludge dewatering and dewatering with subsequent treatment by ionizing radiation. Initial phases of sludge dewatering resulted in stimulation of bacteria growth, but reductions in moisture content below about 50% by weight caused a proportional reduction in bacterial numbers, generally reaching one order of magnitude or less in comparison with the original sludge. The rate of inactivation of bacteria by ionizing radiation in sludge was usually modified to some degree by variations in moisture content. Reduced moisture levels provided some degree of protection from ionizing radiation for most bacteria. The radiation resistance of Salmonella typhimurium was about doubled in dried sludge. However, none of the bacterial species tested required an excessive amount of irradiation to inactivate 90% of their populations. The study results indicate that loss of water by evaporation is not an adequate method for reducing the bacterial population in sludge when used alone. Also, although the rates of bacterial inactivation by ionizing radiation in sludge can be altered by changes in moisture content, the amount and direction of alteration varies with bacterial species. Treatment with ionizing radiation appears to be a feasible method of destroying bacterial pathogens in both liquid and dewatered sludges. (Carroll-FRC)
W82-00489

**SURVIVAL OF ENTEROVIRUSES IN RAPID-INFILTRATION BASINS DURING THE LAND APPLICATION OF WASTEWATER,**
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
C. J. Hurst, C. P. Gerba, J. C. Lance, and R. C. Rice.
Applied and Environmental Microbiology, Vol 40, No 2, p 192-200, August, 1980. 3 Fig, 7 Tab, 25 Ref.

Descriptors: *Enteroviruses, *Land disposal, Wastewater treatment, Infiltration, Infiltration rate, Poliovirus, Flooding, Wastewater disposal, Waste disposal, Effluents, Groundwater pollution.

The measurement of enterovirus downward migration through soil during rapid infiltration of sewage effluent was undertaken. Measurement was also made of enterovirus inactivation rates in soil of rapid-infiltration basins during periods of flooding and drying. The basins used in the study were part of a pilot system designed to study the high-rate land treatment of wastewater for water quality improvement and groundwater recharge. Two field studies were performed. After 5 days of flooding, the amount of seeded poliovirus type 1 that had migrated 5 to 10 cm downward through the soil profile was 11% of that remaining at the initial burial depth. The amount of echovirus type 1 determined to have moved an equal distance was at least 100-fold less. Migration of naturally occurring enteroviruses during infiltration of sewage effluent through soil could not be measured with accuracy because of the possibility of virus survival from previous applications of effluent. The rate of inactivation for seeded poliovirus 1 and echovirus 1 buried in the infiltration basins ranged between 0.04 and 0.15 log-10 units per day during the time the basins were flooded. Inactivation of these same seeded virus types and of indigenous enterovirus populations in the infiltration basins during the drying portion of the sewage application cycle ranged between 0.11 and 0.52 log-10 units per day. The rate of virus inactivation was dependent on the rate of soil moisture loss. These results indicate that drying cycles during the land application of wastewater enhance virus inactivation in the soil. (Baker-FRC)
W82-00496

## 5E. Ultimate Disposal Of Wastes

**LAND RESTORATION FOLLOWING OIL-WELL DRILLING,**
For primary bibliographic entry see Field 5D.
W82-00057

**ELECTROPLATING WASTEWATER SLUDGE CHARACTERIZATION,**
Centec Corp., Reston, VA.
J. W. Meredith, J. A. McCarthy, and A. Procko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-190928, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-064, May 1981. 3 p.

Descriptors: *Electroplating, *Industrial wastewater, *Sludge, *Leaching, Hydrogen ion concentration, Heavy metals, Water pollution sources, *Land disposal, Runoff, Interstitial water.

The problem of disposal and handling of solid wastes from electroplating wastewater treatment systems has been difficult and complex. This three-phase project was initiated to provide information concerning the physical and chemical characteristics of electroplating wastewater treatment sludges and their performance in a leaching environment. Phase I physically and chemically characterized representative electroplating sludges, determined their response to the EPA extraction procedure (EP), and determined the sensitivity of the parameters in the EP. Phase II involved laboratory testing to determine the performance of electroplating sludges under less aggressive leaching conditions than those in the EP. Phase III experiments were designed to validate conclusions drawn from Phase II by conducting field tests on an actual segregated metal hydroxide landfill. Two variables were found to have a major effect on the results obtained by the leaching procedures tested during Phase I: the composition and amount of free and interstitial wastewater present in the sludge, and the pH of the final extract. Electroplating wastewater treatment sludges in general do not leach heavy metals at a significant rate when deionized water is used as a leaching medium. Mildly acidified leaching water results in higher rates of heavy metal leaching. A sample of combined leachate and runoff from a segregated hydroxide landfill was found by analysis to pass drinking water standards. (Moore-SRC)
W82-00095

**CROPPING SYSTEMS FOR TREATMENT AND UTILIZATION OF MUNICIPAL WASTEWATER AND SLUDGE,**
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
B. G. Ellis, A. E. Erickson, and L. E. Leach.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-187254, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-065, July 1981. 9 p, 1 Fig, 5 Tab.

Descriptors: *Wastewater disposal, *Land disposal, *Sludge disposal, *Crop yield, Corn, Forages, Nitrogen removal, Heavy metals, Groundwater contamination, Cost analysis, Municipal wastes.

An attempt was made to develop a cropping system which would remove nitrogen from added wastewater for a longer period than the four weeks in which corn removes nitrogen. Corn was interplanted with red clover, alfalfa, birdsfoot trefoil, and ryegrass which gave satisfactory corn yields. Yields were drastically reduced when corn was grown with tall fescue or orchard grass, and were unchanged when the forage was rye, quackgrass or reed canary grass. All the interplantings were effective at removing nitrogen from the wastewater. A second experiment determined the effects of adding a metal contaminated sludge on these same forage-corn interplantings, and on corn alone. Sludge applied at 7 metric tons per ha gave little increase in nitrate in the soil, but nitrate levels were increased at application rates of 22 t/ha. Corn yields were increased at all sludge application rates, with the most economic rate being 11 t/ha; the highest yields were obtained when the sludge application was repeated each year. Zinc, copper, and nickel levels increased in the groundwater after sludge application, but only zinc levels were raised in the corn grain. Sludge application rates of less than 54 t/ha do not appear to be a hazard either to the crop or to the groundwater. (Brambley-SRC)
W82-00097

**LINING OF WASTE IMPOUNDMENT AND DISPOSAL FACILITIES,**
Matrecon, Inc., Oakland, CA.
Environmental Protection Agency Report SW-870, September 1980. 406 p, 46 Fig, 48 Tab, 52 Ref, 9 Append.

Descriptors: *Lining, *Waste disposal, *Waste storage, *Leachates, Solid waste disposal, Water pollution prevention, Groundwater pollution, Land disposal, Sludges, Absorption, Soil sealants, Clays, Municipal wastes, Solvents, Bacteria.

The use of man-made materials of low permeability to line waste storage and disposal impoundments has been demonstrated to be a feasible method of preventing leachate and waste liquid components from leaking from an impoundment and subsequently entering and polluting groundwater. This manual is intended to provide information and guidance in the selection, performance, installation, and maintenance of specific liners and cover materials for specific containment situations, based upon the current state of the art of liner technology and other pertinent technologies. Wastes in lined facilities include: municipal solid waste, hazardous industrial wastes, and other nonradioactive and special wastes. The linings include remolded and compacted soils and clays, admixes, polymeric membrane liners, sprayed-on-liners, soil sealants, and chemisorptive liners. Liners function by two mechanisms: to impede the flow of the pollutant and pollutant carrier, usually water, into the subsoil and thence into the groundwater; or to absorb or attenuate suspended or dissolved pollutants in order to reduce the concentrations. From the standpoint of pollution and need for containment, it is the waste fluids which are of primary concern. The complexity of waste fluids, which include water, dissolved organic and inorganic components, organic chemicals and solvents, and bacteria, magnify the problems of containment. (Moore-SRC)
W82-00099

**PHOSPHORUS DYNAMICS OF A FLORIDA FRESHWATER MARSH RECEIVING TREATED WASTEWATER,**
Florida Univ., Gainesville. Center for Wetlands.
T. J. Dolan, S. E. Bayley, J. Zoltek, Jr., and A. J. Hermann.
Journal of Applied Ecology, Vol 18, No 1, p 205-219, April, 1981. 2 Fig, 7 Tab, 40 Ref.

Descriptors: *Phosphorus compounds, *Secondary wastewater, *Tertiary wastewater treatment, *Marshes, Nutrients, Fate of pollutants, Wastewater disposal, Wastewater treatment, Wetlands, Vegetation, Effluents, Florida, *Phosphorus removal, *Wastewater disposal.

Phosphorus in secondary effluent, applied weekly for a year to a test plot, was over 97% assimilated.

Soil (peat, clay, and sand) was the major sink, with secondary sinks in the below-ground biomass and litter. Three 2000 sq meter plots received effluent at the rates of 1.3, 3.8, and 10.2 cm per week, with a control plot receiving 3.8 cm per week of freshwater. Vegetation present included Sagittaria lancifolia, Pontederia cordata, Panicum spp. and Hibiscus sp. The plot with the highest rate of effluent loading showed increases in net production of plant shoots, litter, root and rhizomes, and in P concentration in living and dead plant tissue, compared with the control plot. There was 38.03 g P per sq meter applied to the high effluent plot during the course of the study; 26.31, 8.81, and 1.97 g P per sq meter were stored in soil, roots, and rhizomes, and litter, respectively. Outflow from the plot was 0.94 g P per sq meter. The freshwater control plot received a total of 0.38 g P per sq meter, stored 0.21 g P per sq meter in the litter, and lost 0.17 g P per sq meter in the outflow. There was no evidence of a spring flush of P from any plot. (Cassar-FRC)
W82-00108

**SLASH TREATMENT AFTER CLEARCUTTING LODGEPOLE PINE AFFECTS NUTRIENTS IN SOIL WATER,**
Utah State Univ., Logan. Dept. of Forestry and Outdoor Recreation.
For primary bibliographic entry see Field 4C.
W82-00130

**ODOROUS COMPOUNDS FROM POTATO PROCESSING WASTE EFFLUENT IRRIGATION FIELDS: VOLATILE ACIDS,**
Science and Education Administration, Berkeley, CA. Western Regional Research Lab.
R. G. Buttery, and J. A. Garibaldi.
Journal of Agricultural and Food Chemistry, Vol 28, No 1, p 158-159, January/February, 1980. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Organic acids, *Food processing wastes, *Odor control, Organic compounds, Acids, Pollutant identification, *Potatoes, Industrial wastes, Waste disposal, Irrigation.

When potato processing wastes are run into crop growing fields, an offensive odor can develop, especially under anaerobic conditions. The free acid fraction of the volatile oil isolated from odorous soil contained the following acids: acetic, propionic, isobutyric, butyric, 3-methylbutyric, pentanoic, hexanoic, and phenylacetic. Some of these acids were found at many times their odor threshold limit: butyric 90-1000 times, pentanoic 7-20 times, 3-methylbutyric 1-24 times, and isobutyric 100-1800 times. Odors may be decreased by encouraging aerobic conditions in the field by preventing pond formation (wider distribution and time interval for effluent application), increasing soil porosity, and ensuring high percolation rates of wastewater into the soil. (Cassar-FRC)
W82-00156

**NITROGEN AVAILABILITY FROM SEWAGE SLUDGE,**
Vermont Univ., Burlington. Dept. of Plant and Soil Science.
F. R. Magdoff, and J. F. Amadon.
Journal of Environmental Quality, Vol 9, No 3, p 451-455, July-September, 1980. 4 Fig, 2 Tab, 14 Ref.

Descriptors: *Sludge, *Land disposal, *Nitrogen, *Crop yield, Corn, Hay, Mineralization, Nitrification, Municipal wastes.

Application was made of aerobically treated secondary liquid sewage sludge to both corn and hay which were growing on Hadley sandy loam and Nellis loam soils. The nine treatments consisted of a check, four ammonium nitrate levels (50, 100, 150, and 200 kg N/ha/yr), and four sludge levels which were chosen to supply amounts of available N similar to the ammonium nitrate rates. Under laboratory conditions about 54% of the organic N added to the sludge-amended corn soils was mineralized. The mineralized N was well correlated with a chemical test of N availability. While the corn and hay on the sludge-amended Hadley soil outyielded the N treatments, nitrate recovery to 1.2 meters in the corn plots indicated that the available N supplied by the sludge treatments was no greater than that supplied by ammonium nitrate. Other factors, such as increased K supply to both crops and residual N effect on second-year hay, perhaps caused the increased yield of crops to sludge over N. Little or no response was noted in corn yields to sludge or N on the Nellis loam. Hay responded more to N than to sludge on the Nellis loam. Estimates of mineralization of organic N from sludge applied to corn and hay averaged 55% for the first year of application. Recovery of N in the corn at harvest plus soil NO3-N to a depth of 1.2 meters was positively correlated with the estimated mineralization of organic N plus the inorganic N added. The autoclaving test of N availability appeared useful in predicting mineralization of organic N from sludge under field conditions. (Baker-FRC)
W82-00158

**SOIL AS A MEDIUM FOR DAIRY LIQUID WASTE DISPOSAL,**
Southern Illinois Univ. at Carbondale. Dept. of Plant and Soil Science.
S-Y. Yang, J. H. Jones, F. J. Olsen, and J. J. Paterson.
Journal of Environmental Quality, Vol 9, No 3, p 370-372, July/September, 1980. 3 Tab, 13 Ref.

Descriptors: *Dairy industry, *Land disposal, Effluents, Industrial wastes, Animal wastes, Farms, Water pollution, Water quality, Biological oxygen demand, Phosphates, Nitrates, Suspended solids.

Attempts were made to determine a design for an effective vegetative-soil filter for liquid dairy waste disposal in relation to the highest loading rate per unit area of land under the most adverse climatic conditions, the filtering action of the vegetation, and the water quality if surface runoff during rainfall and snowmelt, and ground water. The soil used was classified as a Hosmer silt loam with an impermeable dense fragipan layer at the 50 cm depth. The experimental area was in tall fescue and had a 3% north facing slope with an intermittent stream at the lower end. Soil moisture and climatic conditions were important parameters affecting land application rates of dairy liquid waste. Large amounts of dairy liquid waste were absorbed and used by the soil and plants in the summer when evaporation and transpiration were high. The most critical period for loading was when the soil was wet or frozen, from the standpoint of controlling runoff pollution from effluent applications. The highest loading rate for zero surface runoff under the most adverse conditions was 0.43 cm/day. The pollutants in the dairy effluent were not effectively removed by flowing over the vegetative-soil filter. BOD5 decreased by 41%, ammonia nitrogen by 36%, suspended solids by 69%, and phosphate phosphorus by 16%. The most probable pollutants of runoff from rainfall and snowmelt were BOD5, ammonium-nitrogen, and phosphate-phosphorus. The field study showed a 99% decrease in BOD5 and a 90% removal of phosphate-phosphorus from the effluent by the soil. (Baker-FRC)
W82-00165

**LEACHING OF CALCIUM AND MAGNESIUM FROM SOIL COLUMNS AS AFFECTED BY FORM OF NITROGEN IN APPLIED SEWAGE,**
California Univ., Davis. Dept. of Land, Air, and Water Resources.
D. Pal, and F. E. Broadbent.
Soil Science Society of America Journal, Vol 45, No 1, p 56-60, 1981. 5 Fig, 8 Tab, 3 Ref.

Descriptors: *Leaching, *Land disposal, *Soil columns, *Calcium, Nitrogen, *Magnesium, Soil solution, Wastewater disposal, Soil profiles, Leachates, Nitrification, Denitrification.

Synthetic sewage containing elevated levels of nitrogen in either the ammonium or nitrate form was applied to soil columns at a rate of 7.5 centimeters per week for 41 weeks. Effluents from the column treated with ammonium sewage had higher concentrations of calcium and magnesium than did those from the column treated with nitrate sewage. When soil columns were treated with treatment plant sewage augmented by the addition of ammonium or nitrate to bring the nitrogen level to about 4 milliequivalents (meq) per liter, ammonium-amended sewage removed 1.32 meq more calcium and 0.84 meq more magnesium per liter of effluent than did nitrate-amended sewage. A third experiment involved application of unamended secondary waste water to columns of two different soils, one lot prior to nitrification and the other after nitrification had proceeded to completion. Calcium elution in Panoche clay loam was the same under both conditions, while magnesium elution was greater when the sewage was nitrified. In tests with Columbia fine sandy loam, somewhat more calcium and slightly less magnesium were eluted by nitrified sewage. When soils received sewages with artificially elevated concentrations of nitrogen, removal of calcium and magnesium were measurably higher when the ammonium form of sewage was applied. However, consistent differences between forms of sewage were not observed at the lower nitrogen levels characteristic of normal sewages. It is concluded that the influence of nitrification on solubility of calcium and magnesium under normal conditions is not sufficient to justify modification of wastewater management practices to prevent increasing the hardness of groundwater as long as the sewage contains normal levels of nitrogen. (Carroll-FRC)
W82-00192

**ANAEROBIC TREATMENT OF HUMAN WASTE IN NORTHERN COMMUNITIES,**
Toronto Univ. (Ontario). Dept. of Civil Engineering.
G. W. Keinke, and D. Prasad.
Canadian Journal of Civil Engineering, Vol 7, No 1, p 156-164, January, 1980. 4 Fig, 8 Tab, 25 Ref.

Descriptors: *Anaerobic digestion, *Waste disposal, *Cold regions, *Waste treatment, Wastewater treatment, Methane bacteria, Bacteria, Coliforms, Domestic wastes, Underground waste disposal, Canada, Permafrost.

A laboratory scale waste pit was operated for 5.5 years at temperatures simulating a human waste disposal pit in the permafrost of northern Canada. Treatment of the concentrated wastes (average COD 110,360 mg per liter) did not occur. At the end of the study coliform bacteria had decreased to negligible numbers, 10 per ml, but total aerobic and anaerobic bacteria remained at 80,000 per ml each, a potential hazard to public health and the environment. Anaerobic digestion of these wastes (called honey bag wastes) proved possible at 20 degrees C, but was uneconomical for these isolated communities. It was possible to process the more dilute black water wastes (average COD 10,210 mg per liter, from vacuum sewers, pressure sewers, or holding tanks) at 20 degrees C and a minimum detention time of 30 days. Operation at lower temperatures may be possible if a high proportion of methane bacteria is maintained in the reactor, either by longer detention time or by the anaerobic contact process. (Cassar-FRC)
W82-00249

**DISPERSAL OF ASPERGILLUS FUMIGATUS FROM SEWAGE SLUDGE COMPOST PILES SUBJECTED TO MECHANICAL AGITATION IN OPEN AIR,**
Science and Education Administration, Beltsville, MD.
P. D. Millner, D. A. Bassett, and P. B. Marsh.
Applied and Environmental Microbiology, Vol 39, No 5, p 1000-1009, May, 1980. 4 Fig, 8 Tab, 22 Ref.

Descriptors: *Sludge, *Fungi, Wastewater, Aspergillus fumigatus, Composting, Atmosphere, Wind, Air pollution, Aerosols, *Fallout.

An aerometric survey was conducted to quantitatively characterize the airborne concentrations of Aspergillus fumigatus at a compost site. The study was conducted at a pilot-scale sewage sludge composting facility and two other selected test sites. Aerosols of A. fumigatus downwind from station-

ary compost piles were insignificant in comparison with those downwind from agitated piles. These aerosols were generated by a front-end loader moving and dropping compost. Aerial concentrations of the fungus at a distance downwind from the point of emission were used to determine an emission rate for A. fumigatus associated with the moving operations. The maximum emission rate, 4.6 million A. fumigatus particles per second, was used to calculate predicted concentrations in an unobstructed plume with restrictive, neutral, and dispersive atmospheric mixing conditions up to 1 km downwind from the emission source. While the dispersal tests were made only under a few different meteorological conditions, the results can be extended to a complete matrix of conditions by using the atmospheric dispersion model and statistical data from the National Weather Service. In evaluating the dispersal of microbial aerosols to locations around composting sites, the frequency distribution of meteorological factors, such as wind speed, wind direction, and atmospheric stability, which contribute to restrictive conditions, and which may be expected to occur in the subject locality, should be considered. (Baker-FRC)
W82-00273

**COMPARATIVE ANALYSIS OF SLUDGE AND REFUSE LEACHATE: A PRELIMINARY REPORT,**
Schneider Engineers, Bridgeville, PA.
D. S. Gilligan, and J. L. Pierce.
Public Works, Vol 112, No 5, p 89-93, May, 1981. 1 Fig, 3 Tab, 5 Ref.

Descriptors: *Landfills, *Sludge disposal, *Heavy metals, *Municipal wastes, Waste disposal, Land disposal, Pesticides, Color, Odors, Coliforms, Incineration, Leachates, *Allegheny County, Pennsylvania.

During the treatment of wastewater at the Allegheny County Sanitary Authority (ALCOSAN), Pennsylvania, several residual by-products are generated which require disposal, usually by landfill. About 60% of the dewatered sludge is incinerated to ash, which is sent to landfills, while the remainder is limed to a pH of 12-12.5 and co-disposed with municipal refuse to privately-owned refuse landfills. A year-long study was conducted to compare leachate characteristics of five simulated municipal sludge and municipal refuse landfill cells. Cells were placed in landfill strate comprising: cell 1, sewage sludge; 2, domestic refuse and sewage sludge in a 4:1 ratio; 3, domestic refuse alone; 4, limed sewage sludge; and 5, domestic refuse and limed sludge in a 4:1 ratio. Metal levels in leachate of cells 1, 2, 4, and 5 compared favorably with concentrations of cell 3, which contained refuse only. All levels of Pb, Cr, Cd, and Ag were 100 times less than extraction procedure toxicity levels. Cell 3 contained higher levels of total coliform, fecal streptococci, and fecal coliform than any of the other cells. No problems with color or odor occurred, and attraction of disease vectors (rodents, flies, etc.) was minimal in all the landfill sites. (Geiger-FRC)
W82-00287

**VIRAL TRANSPORT THROUGH SOIL COLUMNS UNDER CONDITIONS OF SATURATED FLOW,**
Texas Univ. Center for Applied Research and Technology at San Antonio.
For primary bibliographic entry see Field 5B.
W82-00295

**STRATEGY FOR RADIOACTIVE WASTE DISPOSAL IN CRYSTALLINE ROCKS,**
Geological Survey, Menlo Park, CA.
J. D. Bredehoeft, and T. Maini.
Science, Vol 213, No 4505, p 293-296, July 17, 1981. 6 Fig, 8 Ref.

Descriptors: *Radioactive waste disposal, *Crystalline rocks, *Groundwater pollution, Waste disposal, Granite, Barriers, Groundwater movement, Flow characteristics, Path of pollutants, Hydrology, Permeability, Saline water, Sedimentary rocks, Rocky Mountain Arsenal, Denver Basin, Illinois Basin, Maryland, Water pollution sources, Water pollution prevention, *Underground waste disposal.

The multiple barriers concept is used to evaluate possible sites for disposal of radioactive wastes. A satisfactory site would be a nonpermeable, crystalline rock mass (granite or gneiss) under a covering of sedimentary rocks whose groundwater flow characteristics are well understood. Under favorable circumstances the groundwater flow operates as an active barrier, preventing the pollutants from reaching the biosphere. In addition, the depository may be placed where groundwater is nonpotable or salty, minimizing the possibility of future human intrusion. Other barriers are the waste's form and encapsulation and a low-permeability, high-adsorption backfill. Sites having characteristics similar to those of the hypothetical situation are the coastal plain of Maryland, the Denver Basin Cretaceous shale sequence (except in areas of oil and gas production), and the Illinois basin. (Cassar-FRC)
W82-00299

**FINAL ENVIRONMENTAL IMPACT STATEMENT; SLUDGE DISPOSAL AND LAND RECLAMATION IN FULTON COUNTY, ILLINOIS.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, January, 1981. 330 p, 43 Fig, 48 Tab, 129 Ref, 3 Append.

Descriptors: *Environmental Impact Statement, *Fulton County, Illinois, *Land disposal, *Sludge disposal, *Land reclamation, Environmental effects, Runoff, Erosion control, Sedimentation, Water pollution, Soil physical properties, Agriculture, Recreation, Employment.

The Metropolitan Sanitary District of Greater Chicago is applying sludge to strip-mined land in Fulton County, and this Environmental Impact Statement presents the observed and projected impacts of continued operations. The sludge is transported by barge and underground pipeline to holding basins, where it is mixed to a uniform consistency and 6% solid content before being pumped into the distribution system. Originally the sludge was sprayed onto the land, but following complaints of odor, the sludge is now disked into the soil. This method also decreases runoff and erosion problems. Some runoff has occurred and some of the retention basins were too small to allow effective siltation. There have been breaks in the sludge pipelines, resulting from expansion and contraction from changes in temperature, which have caused violations of water quality standards. The physical properties of the soils have improved and crop productivity has increased. Former agricultural land has been put back into use for agricultural and recreational uses. No adverse health effects have been reported, and they will be prevented by appropriate agricultural use of the land. The project has given employment to about 120 persons for 6-8 months each year. (Brambley-SRC)
W82-00360

**STATE-OF-THE-ART OF LIQUID WASTE DISPOSAL FOR GEOTHERMAL ENERGY SYSTEMS: 1979,**
Battelle Pacific Northwest Labs., Richland, WA.
L. J. Defferding.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV-0083, Price codes: A12 in paper copy, A01 in microfiche. Department of Energy Report DOE/EV-0083, June 1980. 252 p, 23 Fig, 12 Tab, 133 Ref, 3 Append. DE-AC06-76RLO 1831.

Descriptors: *Geothermal resources, *Resources development, *Wastewater disposal, *Liquid wastes, Injection wells, Evaporation pans, Surface water, Wastewater treatment, Legal aspects, Environmental effects, Economic aspects, Waste characteristics.

As geothermal resources are developed as energy sources, safe disposal methods must be found for the large volumes of wastes. Techniques currently in use are direct discharge into surface waters, deep-well injection, and ponding for evaporation. Additional techniques with little or only experimental use are treatment and release to surface water, consumptive secondary use, injection into a non-producing horizon, and treatment and injection. All the disposal methods have to be considered in relation to the technical, legal, environmental and safety aspects, and to their overall economics. Other considerations are the variability of the waste fluid properties and the site-specific variables of geology and environmental setting. With present legal and environmental constraints subsurface injection is the most popular disposal method, but it is an expensive method, there have been technical problems with equipment, and some treatment will probably be necessary. (Brambley-SRC)
W82-00375

**ENGINEERING ASSESSMENT OF VERMICOMPOSTING MUNICIPAL WASTEWATER SLUDGES,**
Camp, Dresser and McKee, Inc., Boston, MA.
J. Donovan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-196933, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-075, June 1981. 4 p, 1 Tab.

Descriptors: *Composting, *Sludge disposal, Vermicomposting, *Biological treatment, Economic feasibility, Municipal wastewater, Organic matter, *Biodegration, *Earthworm feeding.

Vermicomposting, the biological degradation of organic matter that occurs as earthworms feed on waste materials, has been advocated by some as a means of stabilizing and disposing of municipal wastewater sludges. Only two species of earthworms, Eisenis foetida and Lumbricus rebellus are commonly mentioned in the literature as suitable for use in waste-vermicomposting operations. These worms can thrive and reproduce in managed conditions and readily feed on high concentrations of organic matter. When these worms are added to shallow beds or windrows of sewage sludge, they feed on the sludge, digest a portion of the organic matter and expel the undigested remains as feces, or castings. The castings produced by worms that have been fed on sludge are dry, virtually odorless, and suitable for use as a soil amendment or low-order fertilizer. Based on review of available literature, dicussion with practitioners, and visits to sites where vermicomposting is being attempted on an experimental scale, the process has been found to be feasible and potentially competitive economically with conventional sludge stabilization techniques such as land spreading of liquid sludge and static pile composting. (Moore-SRC)
W82-00385

**LIME STABILIZATION AND ULTIMATE DISPOSAL OF MUNICIPAL WASTEWATER SLUDGES,**
Camp, Dresser and McKee, Inc., Boston, MA.
R. M. Otoski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-198160, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-076, June 1981. 4 p, 2 Fig, 1 Tab.

Descriptors: *Lime, *Sludge disposal, *Wastewater treatment, *Sludge conditioning, Land disposal, Municipal wastewater, Hydrogen ion concentration, Odor control, Pathogens.

The process of lime stabilization involves adding lime to wastewater-derived sludge in quantities sufficient to raise the pH of the sludge to 12.0 for a contact period of at least 2 hours. The high pH reduces levels of pathogenic bacteria and viruses in the sludge and controls putrefaction and orders. Visits were made to 28 wastewater treatment facilities in New England and New York at which lime stabilization of sludge was reportedly being practiced on a permanent, interim or seasonal basis. In fact, true stabilization was not achieved at some of the plants visited; several routinely limed sludge to

pH levels slightly below 12. Sludge stabilization with lime can be simple and inexpensive and can be used as a backup or interim system, or to upgrade a system, or instituted as a less costly system. The only lime stabilization method rated fully acceptable is the addition of lime to mixed batch tanks. Adding lime before dewatering with the use of equipment intended for sludge conditioning requires close operator attention. Adding lime directly to dewatered sludge cake has not yet been consistently effective in bacterial kills. Stockpiling provides flexibility in land-application schedules, but if pH drops, bacteria can regrow in the stockpiles. (Moore-SRC)
W82-00386

**CHEMICAL RECOVERY FROM COAL CONVERSION WASTES BY CONCENTRATION,**
Concentration Specialists, Inc., Andover, MA.
For primary bibliographic entry see Field 5D.
W82-00436

**WATER-RELATED ENVIRONMENTAL CONTROL REQUIREMENTS OF WASTE-TO-ENERGY CONVERSION,**
Iowa State Univ., Ames.
For primary bibliographic entry see Field 5D.
W82-00443

**DEEP WELL INJECTION OF INDUSTRIAL WASTES,**
A. S. Athavaley, R. J. Funk, R. G. Sweet, and W. A. Coffey.
Industrial Wastes, Vol 27, No 3, p 28-30, 33-34, May/June, 1981. 3 Fig, 2 Tab.

Descriptors: *Injection wells, *Oil industry, Industrial wastes, *Underground waste disposal, Acidic water, Wastewater treatment, Wastewater disposal, Corpus Christi, Texas.

Spent caustic from an olefins plant at Corpus Christi, Texas represents a problem wastewater stream for disposal. The concentration of the caustic can range from two to five percent. The wastewater pH is expected to run consistently at about 13. The sulfide content may range from 500 to 35,000 mg/liter. About 50,000,000 gallons of wastewater will have to be disposed of annually when the plant is in full operation. This represents a design average flow rate of about 100 gpm, with minima and maxima ranging from 40 to 100 gpm, respectively. The wastewater cannot be discharged to any watercourse due to its toxic and refractory characteristics. Treatment for surface disposal is not economically feasible, due to the tight restrictions imposed on levels of total organic carbon and chemical oxygen demand. A disposal well system for handling the caustic wastewater has been designed with a 20 year project life. It was designed to comply with regulations of the various government branches of Texas and the federal government as well. Both an operational and a standby disposal well were drilled, to give a combined, firm capacity of 200 gpm. Because the wastewater was incompatible with the reservoir formation water, it was necessary to develop a buffer placement program, which is a one-time operation. This prevents the formation of precipitates when the formation water component is contacted by the wastewater and provides a barrier which delays contact between injected wastewater and formation water. This helps avoid plugging of the injection well with precipitates. (Baker-FRC)
W82-00475

**EFFECTS OF MOISTURE CONTENT ON LONG-TERM SURVIVAL AND REGROWTH OF BACTERIA IN WASTEWATER SLUDGE,**
BDM Corp., Albuquerque, NM.
J. G. Yeager, and R. L. Ward.
Applied and Environmental Microbiology, Vol 41, No 5, p 1117-1122, May, 1981. 4 Fig, 10 Ref.

Descriptors: *Moisture content, *Sludge, *Enteric bacteria, Bacteria, *Wastewater treatment, Liquid sludge, Sewage bacteria, Survival, Population density, Population dynamics, *Sludge drying.

Although long-term storage is often used for pretreatment of wastewater sludge prior to land application, little is known about the effects of this form of treatment on the numbersof bacterial pathogens in sludge. The effects of moisture content of sludge on the inactivation rates of bacteria during long-term storage and on bacterial regrowth potential were investigated. Cultures of six strains of fecally associated bacteria grown in sterilized liquid sludge (5% solids) were all quite stable at this moisture level for over 90 days at 21C. Bacterial inactivation rates following evaporation occurring during long-term storage at this temperature were generally proportional to the moisture losses of the samples. However, in dried sludge containing more than 90% solids, all but one of the bacteria species studied were found to be extremely stable. Bacteria indigenous to sludge were also found to survive for long periods in dried sludge. Bacteria isolates in sterilized raw sludge were found to undergo regrowth rapidly at 37 degrees C in samples containing not more than 75% solids, but no regrowth occurred in samples containing more than 85% solids. Although seeded Salmonella typhimurium grew in the presence of indigenous bacteria in both liquid and dewatered raw sludges, the population densities attained were well below that found in sterilized samples of the same sludges. While the number of salmonella dropped below detectable limits within a few days in sludges containing viable indigenous organisms, little decrease occurred during this time with salmonella grown in previously sterilized sludges. (Carroll-FRC)
W82-00493

**EFFECTS OF SEWAGE EFFLUENT APPLICATION ON LITTER FALL AND LITTER DECOMPOSITION IN CYPRESS SWAMPS,**
Florida Univ., Gainesville. School of Forest Resources and Conservation.
G. S. Deghi, K. C. Ewel, and W. J. Mitsch.
Journal of Applied Ecology, Vol 17, No 2, p 397-408, August, 1980. 4 Fig, 5 Tab, 28 Ref.

Descriptors: *Swamps, *Land disposal, *Litter, Organic matter, Wastewater, Effluents, Decomposition, *Florida, *Wetlands, Forests, *Cypress swamps, Wastewater treatment.

Cypress domes, which are characteristic of ecosystems in Florida, are stillwater swamps dominated by pond cypress. The adaptation of vegetation and soils in cypress domes to saturated conditions and the absence of overland flow to other bodies of water has resulted in consideration of these sites for recycling of secondarily treated sewage effluents. The ability of cypress domes to absorb the nutrients and microbes in these effluents and the effects of treatment with sewage effluents on litter production and decomposition rates were studied at four sites in Florida over a two-year period. Although no increases in litter fall attributable to treatment with sewage effluent were found in the experimental domes, data from other studies indicates that this rate may increase. Phosphorus cycling in the cypress domes seemed to be speeded by treatment with effluent and with groundwater. The lower concentration of oxygen in the sewage treated domes did not hinder the decomposition process. Decomposition of cypress needles occurred more rapidly in wet areas than in dry sites, but there was no difference in decomposition rates between deep and shallow wet sites. Biomass losses appear to be dependent on temperature and moisture. Decomposition may proceed more rapidly in domes treated with sewage effluent than in untreated domes as a result of the increased nutrient levels in the substrate. Since increases in litter fall do not result in decreases in the decomposition rate, application of sewage effluent should not result in an increase in the normal accumulation of organic matter in the domes until a new steady-state level is reached. (Carroll-FRC)
W82-00499

## 5F. Water Treatment and Quality Alteration

**CHEMICAL, PHYSICAL, AND RADIOLOGICAL QUALITY OF SELECTED PUBLIC WATER SUPPLIES IN FLORIDA, FEBRUARY-APRIL 1980,**
Geological Survey, Tallahassee, FL. Water Resources Div.
B. J. Franks, and G. A. Irwin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-227910, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-31, 1981. 59 p, 4 Fig, 6 Tab, 13 Ref.

Descriptors: *Potable water, *Water quality, *Water supply, *Water treatment, Water quality standards, Water analysis, Chemical analysis, Surface water, Groundwater, Desalination, *Florida, Drinking water, Regulations.

Virtually all treated public water supplies in Florida meet the National Interim Primary and Secondary Drinking Water Regulations. These findings are based on a water-quality reconnaissance of 126 raw and treated public water supplies throughout the State during the period February through April 1980. Primary drinking water regulations maximum contaminant levels were rarely exceeded, although mercury (1 site), fluoride (2 sites), and radionuclides (3 sites) in water supplies were above established maximum contaminant levels. Dissolved solids, chloride, copper, manganese, iron, color, sulfate, and pH, were occasionally slightly in excess of the recommended maximum contaminant levels of the secondary drinking water regulation. The secondary regulations, however, pertain mainly to the esthetic quality of drinking water and not directly to public health aspects. (USGS)
W82-00010

**PROCESS FOR THE REMOVAL OF INORGANIC SALTS FROM A WATER STREAM,**
D. W. Coillet.
U.S. Patent No. 4,234,419, 11 p, 1 Fig, 1 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 1104-1105, November 18, 1980.

Descriptors: *Patents, *Water treatment, *Industrial water, Wastewater treatment, Water purification, *Ion exchange, Chemical precipitation, Brine disposal, Byproducts, Potable water, Salt removal, Dissolved solids, Regeneration.

Inorganic salts are removed from an unpotable water stream, particularly a salt-containing inland water stream. Such waters include ground water, including geothermal brine, waste waters, including field drainage and urban waste water, and aqueous waste from the operation of evaporative cooling towers and certain processes of industry and energy conversion. The stream is passed sequentially through anion and cation exchange beds. Periodically the anion exchange bed is regenerated with sodium hydroxide and the cation exchange bed with hydrochloric acid to form spent regenerant streams which are combined with hydrochloric acid in the presence of calcium ion to precipitate calcium salts of anions from the mixture. The soluble portion is then mixed with sodium hydroxide in the presence of carbonate ion to precipitate insoluble cations from the mixture as hydroxides or carbonates. The soluble portions, comprising essentially an aqueous sodium chloride stream, is separated into a more concentrated and less concentrated portion. The more concentrated stream is electrolzed to provide a source of hydrochloric acid and sodium hydroxide for the above steps, while the less concentrated stream is recovered as a source of potable water. (Sinha-OEIS)
W82-00055

**FLUORIDATION SYSTEM,**
J. N. Leo.
U.S. Patent No. 4,234,425, 4 p, 2 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 1107, November 18, 1980.

Descriptors: *Patents, *Water treatment, *Fluoridation, Public health, Equipment, Flow control, Venturi meters.

A fluoridation system includes a venturi capable of being inserted into a water line along its length.

The venturi includes a throughbore having a diminishing tapered section followed by an increasing tapered section in the direction of liquid flow and a passage which intersects the throughbore perpendicularly. A mechanism associated with the venturi withdraws water from the water line and a first conduit for transferring water from the withdrawing mechanism contains a flow rate measurer and flow control. The fluoride chamber is connected to the outlet end of the first conduit, and a second conduit connects the fluoride chamber with the perpendicular passage of the venturi. (Sinha-OEIS)
W82-00061

**PROCESS FOR REMOVING ALKALINITY AND HARDNESS FROM WATERS,**
Water Refining Co., Inc., Middletown, OH. (Assignee).
R. E. Wiegert.
U.S. Patent No. 4,235,715, 6 p, 2 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 4, p 1531, November 25, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, *Hardness(Water), *Alkalinity, Separation techniques, Industrial water, Ion exchange, Resins, Cation exchange, Chemical reactions, Boiler feed water, Regeneration.

Raw water is fed to a first column containing a weak acid cation exchange resin in hydrogen form where alkalinity causing ions and hardness causing ions to the extent of alkalinity are converted to carbonic acid. The carbonic acid, which hydrolyzes to dissolved oarbon dioxide, is stripped from the water in a decarbonation unit by passing air countercurrent to the flow of water through the unit. The water is then fed to a second column containing a weak acid cation exchange resin in sodium form which removes residual hardness causing ions along with neutralization of any mineral acids or residual dissolved carbon dioxide. Both resins are substantially completely regenerated upon exhaustion to provide a process in which the maximum capacities of the resins are utilized, and the process is carried out with a minimum of monitoring and control. In terms of operating and investment costs, it is much more economical to treat raw feed water to remove hardness and alkalinity prior to introducing it into equipment. (Sinha-OEIS)
W82-00063

**A/C PIPE - ASSESSMENT OR ADVOCACY,**
A/C Pipe Producers Association, Arlington, VA.
J. F. Welch.
Water/Engineering and Management, Vol 128, No 5, p 44, 48, 54, 57-58, May, 1981. 1 Fig, 1 Tab, 29 Ref.

Descriptors: *Asbestos, *Asbestos cement, *Public health, *Drinking water, Water quality, Pipes, *Pipelines, Water transport, Water mains, Carcinogens, Evaluation.

A commentary is presented on the issue of asbestos in drinking water, with emphasis on the assessment of the safety of asbestos-cement (A/C) pipes. While it is known that asbestos-cement pipe will corrode, the extent has not been determined to which people are affected by this corrosion. No one knows exactly how many miles of A/C pipe are exposed to corrosive waters or what levels of asbestos in water are dangerous to people. Airborne asbestos has been known to cause health effects in exposed workers, but there is little scientific information on the effects of asbestos ingestion by man or laboratory animals. It is not known whether asbestos fibers cross the intestinal tract. There are no animal studies or epidemiological studies linking asbestos ingestion to cancer, and several studies have indicated that there is no cancer hazard. More research is needed before realistic water quality criteria can be set for asbestos fibers. (Small-FRC)
W82-00070

**AN ALTERNATIVE SOLUTION TO THE THM PROBLEM,**
Dallas City Manager's Office, TX.
I. M. Rice, and M. E. Bolding.
Water/Engineering and Management, Vol 128, No 5, p 59-60, 65-66, May 1981. 6 Tab.

Descriptors: *Trihalomethanes, *Drinking water, *Ammonia, *Pilot plants, Chlorination, Chlorine, Hydrogen ion concentration, Activated carbon, Water supply, Dallas, Texas.

Pilot plant studies evaluated the extent to which trihalomethane formation in drinking water could be reduced by reducing the ammonia content of prechlorinated water. Tests were undertaken using three levels of chlorine, three different pH values, and operations with or without ammonia present. The pentane extraction method was used for all trihalomethane tests. Results indicated that advance ammonia feed could reduce trihalomethane formation without sacrificing good bacterial water quality. Coliforms were uniformly removed from the treated water in every case where ammonia was employed. Application of ammonia followed by addition of chlorine at the intake to the plant was more effective in preventing THM formation than application of chlorine at later stages. There were daily and weekly fluctuations in precursor content. Thus, trihalomethanes in drinking water can be reduced without the installation of granulated activated carbon treatment. These studies were performed on water from the Dallas, Texas system. (Small-FRC)
W82-00072

**HISTORY OF A WATER CHEMICAL,**
R. W. Ockershausen.
Water/Engineering and Management, Vol 128, No 5, p 73-75, May, 1981. 1 Fig.

Descriptors: *Alum, *Aluminum sulfate, *Clarification, Chemical precipitation, *Water treatment, Drinking water, History, Phosphorus removal.

The history of the use of alum, aluminum sulfate, in water treatment is presented. One hundred years ago alum saw continuous daily use at the Somerville and Raritan Water Company in the New Jersey water filtration plant, and there is evidence that this chemical has been used for centuries to clarify water. Lump alum was popular at the turn of the century, and ground or granular alum came into use in the 1920's. Liquid alum became available in the 1940's and both liquid and dry are used today. Alum continues to be the major coagulant used in water and wastewater treatment. It can be used for clarification, phosphorus reduction, and impurity removal. Dry alum requires more manufacturing steps, so liquid is the least expensive. This factor is making it more popular during today's inflationary times. Raw materials of domestic origin give assurance that supplies will be plentiful in the future. (Small-FRC)
W82-00074

**DISTRIBUTION AND BALANCE OF VOLATILE HALOGENATED HYDROCARBONS IN THE WATER AND AIR OF COVERED SWIMMING POOLS USING CHLORINE FOR WATER DISINFECTION,**
Bremen Univ. (Germany, F.R.).
U. Lahl, K. Batjer, J. V. Duszeln, B. Gabel, and B. Stachel.
Water Research, Vol 15, No 7, p 803-814, July, 1981. 6 Fig, 10 Tab, 42 Ref.

Descriptors: *Swimming pools, *Public health, *Chlorination, Trihalomethanes, Chloroform, Water treatment, Disinfection, Organic compounds, Recreation, Ozonation, Ultraviolet radiation, Chlorinated hydrocarbons, *Fate of pollutants, *Indoor swimming pools.

Chlorination of water in covered swimming pools in Bremen, Germany, produced trihalomethanes (THM) (largely CHCl3, CHCl2Br, CHClBr2, and CHBr3) at total concentrations up to 1224 micrograms per liter. Comparing THM concentrations in inflow and outflow showed that there was a 20-30% increase after five hours. THM formation depended on the amount of free active Cl, concentration of organic precursors (fulvic acids, humic acids, urine), concentration of other compounds reacting with Cl, concentration of Br ions, and number of pool visitors. After water treatment methods were refined (less chlorine, elimination of surface waters as a source, more fresh water added) the total THM levels dropped from 800 micrograms per liter in December 1978 to about 100 micrograms per liter in February 1979 and remained at that level. The concentration of THM found in air above the pools varied widely with location and distance above the water surface; the highest measured level was 384 micrograms per cu meter, and the average 0.1 micrograms per cu meter. The maximum cancer risk, based on chloroform, was calculated at 1 cancer event per million visitors per year for weekly visits in a covered pool in Bremen. Alternative disinfection methods include ultraviolet radiation and indirect ozonation. (Cassar-FRC)
W82-00128

**REACTIONS OF CHLORINE WITH SELECTED AROMATIC MODELS OF AQUATIC HUMIC MATERIAL,**
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. L. Norwood, J. D. Johnson, R. F. Christman, J. R. Hass, and M. J. Bobenrieth.
Environmental Science and Technology, Vol 14, No 2, p 187-190, February, 1980. 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Chlorination, *Humic acids, Natural waters, Chloroform, Drinking water, Disinfection, Water treatment, Chemical reactions, Hydrocarbons, Decomposing organic matter.

Chloroform yields and chlorine demands were measured for structures representative of humic degradation products and to identify in selected cases other chlorinated end products. Several compounds designed to model the monomeric components of aquatic humic material were reacted with aqueous chlorine at pH 7. Chloroform production and chlorine demand were measured for each compound over varied time periods. All compounds studied produced measurable amounts of chloroform with resorcinol derivatives showing the greatest yields. In addition, the chlorination reactions of resorcinol and 3-methoxy-4-hydroxycinnamic acid were studied in depth with GC/MS. The resorcinol reaction was found to proceed through several chlorinated intermediates, of which the most abundant was 3,5,5-trichlorocyclopent-3-ene-1,2-dione, to chloroform and chlorinated acids. Chlorination of the cinnamic acid derivative produced chlorinated substitution products and chlorophenols, which broke down upon further reaction to chloroacetic acids. (Baker-FRC)
W82-00254

**HYGIENE OF DRINKING WATER IN DEVELOPING COUNTRIES,**
Amsterdam Water Works (Netherlands).
C. van der Veen.
Aqua, No 5, p 2-7, 1980. 4 Tab, 21 Ref.

Descriptors: *Developing countries, *Drinking water, *Rural areas, *Water treatment, Water quality control, Potable water, Human diseases, Public health, United Nations, Organoleptic properties, Water supply, Water quality.

The provision of safer drinking water supplies in developing countries is considered. Water-related diseases which pose problems of hygiene may be classified as waterborne diseases, water-washed diseases, water-based diseases, and diseases with related insect vectors. The relationships between a nation's availability of a good water supply and the health standard of its people are illustrated in data from various countries. Differences in methods of water procurement from urban and rural areas are mentioned, and technologies associated with spring water, groundwater, roof drainage and ground catchment, surface water, and artificial recharge are explored. Often attempts to supply public water to rural areas fail due to a lack of education of the users. Old water sources may serve holy functions, provide a place of social gathering, and are more familiar in taste to the native populations.

Some people may use public water only intermittently, so that disease conditions still exist. Often, the people are too poor to pay for public water and therefore they discontinue using it. Water projects should be financially self supporting. In 1977, the United Nations (UN) launched a Water Decade which set as its goal the provision of adequate supplies of quality drinking water for all people and the proper disposal of waste waters by 1990. UN figures indicated that in 1975, 62% of the populations of developing countries were not served by safe water supplies. The International Water Supply Association (IWSA) has appointed a task force which plans to stimulate the water supply authorities in developing countries by availing them of the knowledge of present technologies. (Geiger-FRC)
W82-00269

**DEVELOPMENT OF A RURAL WATER DISTRICT,**
Corlew (M. B.) and Associates, Inc., Edwardsville, IL.
For primary bibliographic entry see Field 6A.
W82-00288

**THE EFFECT OF BENTONITE CLAY ON OZONE DISINFECTION OF BACTERIA AND VIRUSES IN WATER,**
Environmental Protection Agency, Atlanta, GA.
D. S. Boyce, O. J. Sproul, and C. E. Buck.
Water Research, Vol 15, No 6, p 759-767, 1981. 1 Fig, 7 Tab, 23 Ref.

Descriptors: *Viruses, *Bacteria, *Ozone, *Bentonite, *Disinfection, Wastewater renovation, Wastewater treatment, Coxsackie virus, Polio virus, Escherichia coli, Bacteriophage, *Clays, Water treatment, Pathogens, Turbidity, Adsorption.

The disinfection potential of ozone for viruses and bacteria adsorbed on bentonite clay particles suspended in water was determined. Viruses used were poliovirus (Sabin Type 1), coxsackievirus A9, and the f2 bacteriophage. Escherichia coli was treated under the same conditions as the virus--unadsorbed or adsorbed on 1 and 5 turbidity units (TU) of bentonite clay (particle size 3-8 mm), up to 0.53 mg per liter ozone, temperature 20 C, pH 7.0, and inactivation times of 10, 20, and 30 sec. Poliovirus, coxsackievirus, and E. coli associated with clay were inactivated at rates similar to the freely suspended organisms. The f2 bacteriophage was inactivated at a slightly slower rate than freely suspended phage. Typical results obtained were: 5 TU adsorbed poliovirus (140 plaque forming units (PFU) per ml), 0.016 mg per liter ozone, > 97% inactivated within 20 sec; 5 TU adsorbed coxsackievirus (220 PFU per ml), 0.019 mg per liter ozone, > 98% inactivated within 20 sec; 5 TU adsorbed f2 bacteriophage (15,000 PFU per ml), 0.061 mg per liter ozone, > 98% inactivated within 20 sec; 5 TU adsorbed E. coli (180 million CFU per ml), 0.038 mg per liter ozone, > 99% inactivated within 10 sec. (Cassar-FRC)
W82-00292

**A 13-MONTH SURVEY OF NEMATODES AT THREE WATER TREATMENT PLANTS IN SOUTHERN ONTARIO, CANADA,**
Waterloo Univ. (Ontario). Dept. of Biology.
J. B. Mott, G. Mulamoottil, and A. D. Harrison.
Water Research, Vol 15, No 6, p 729-738, 1981. 7 Fig, 3 Tab, 38 Ref.

Descriptors: *Drinking water, *Nematodes, *Water treatment, Aquatic animals, *Canada, Settling basins, Turbidity, Rainfall, Chlorination, Seasonal variation, River flow.

Nematodes were detected in almost every sample of treated water from three Canadian cities during a 13-month survey. In general, numbers at Brantford were lower (0 to 5.6 per liter) than at Cayuga (maximum 42.5 per liter) and Delhi (maximum 38.7 per liter). Brantford has the largest facility and most extensive water treatment (prechlorination, coagulation, settling, rapid sand filtration, postchlorination, and fluoridation). The water source is a slow-moving canal leading from the Grand River. At Cayuga and Delhi, water treatment is less extensive (coagulation, chlorination, and sand filtration). Water sources are direct from the Grand River and the North Creek, respectively. Nematode concentrations increased with high river flow, heavy rainfall, and high raw water turbidity. Lowest concentrations were found during the winter months. A settling tank or pond for raw water and high levels of prechlorination are recommended to reduce nematode counts. (Cassar-FRC)
W82-00294

**CUTTING THE WATER LOSSES,**
Northumbrian Water Authority, Gosforth (England).
B. Smith.
Water, No 33, p 2-4, July, 1980. 1 Fig.

Descriptors: *Water conveyance, *Leakage, *Maintenance, Water supply systems, Economic aspects, Technology, Reservoirs, Water mains, Pipes, Conveyance structures, *Great Britain.

There has been increasing public concern regarding leakage control policies of water supply systems in Great Britain as a result of increased opposition to the development of new water supply sources, particularly those involving the construction of impounding reservoirs. There are five main leakage control methods: passive leakage control (repairing only leaks which become self-evident), regular sounding, district metering with selective inspection, waste metering with selective inspection, and combined district and waste metering with selective inspection. Although the formation of pressure zones can be used with each of these control methods, there is no clear information on the magnitude of leakage reduction which can be expected from a specific reduction in pressure. Selection of the most economic leakage control measure in a given situation will be affected by such factors as the cost of producing water, the need for pumping, financial contraints, topography, and the overall extent of the leakage problem. The British Working Group on Waste of Water has developed a comprehensive procedure for determining a leakage control policy for any system, irrespective of current practice, in which the relevant local factors and constraints are considered. (Carroll-FRC)
W82-00310

**TREATMENT WORKS--THE DESIGNER'S PROBLEMS,**
Hill (G. H.), Manchester (England).
P. B. Connery, and J. B. Butler.
Water, No 30, p 7-9, January, 1980.

Descriptors: *Water treatment facilities, *Design criteria, *Planning, Site selection, Water treatment, Economic aspects, Monitoring, Water pollution control, Water quality management, Design standards.

Designers are responsible for the integration of the various treatment processes, structures, and equipment into a water treatment facility which will enable the operator to produce water or effluent of the required quality efficiently. Important aspects which the designer must consider include selection of the site, raw water parameters, standards for treated water quality, and type of facility required. Factors impacting on site selection include proximity to sources of treatable water and to users, elevation, site ground conditions, site topography, distance from chemical supply sources, and access for delivery vehicles. Energy conservation is playing an increasingly important role in site selection decisions. The development of information on sources of water likely to be exploited is creating a better basis for the evaluation of the raw water conditions which may be expected. Changing standards for treated water quality raise questions as to whether designs for new plants should include allowances for possible addition of other treatment processes at a later time. The inclusion of raw water storage facilities can significantly reduce the range of the quality of the water to be treated and can simplify treatment. The rapid advance of technology in water treatment also raises questions concerning the design life of facilities. Treatment facilities' designs should be flexible enough to permit expansion as additional capacity is needed and incorporation of additional processes or innovations at a future date. Controls should be selected to be compatible with the quality of monitoring available. (Carroll-FRC)
W82-00312

**MATHEMATICAL EFFICIENCY CONCERNS IN WATER DISTRIBUTION NETWORK CONSIDERATIONS,**
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
S. Gupta, E. A. McBean, and J. R. Cousins.
Canadian Journal of Civil Engineering, Vol 7, No 1, p 78-83, 1980. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Network design, *Computer models, *Design criteria, *Water distribution, Mathematical models, Water supply systems, Comparison studies.

A comparison of three computerized methods for analyzing water distribution systems shows that the Newton-Raphson technique has a slight advantage over the Hardy-Cross method. Total costs of all three models in a 22-node system are about $30; for 68 nodes, about $60 for the Newton-Raphson and Hardy-Cross methods, and $135 for the linear algebra technique. To decrease modeling costs, schematization models representing the same network, but with fewer nodes, may be used for design studies, which require many repetitive runs. (Cassar-FRC)
W82-00339

**SILICATES AS NONSPECIFIC ADSORBENTS OF BACTERIOPHAGE: A MODEL FOR PURIFICATION OF WATER FROM VIRUSES,**
Israel Inst. for Biological Research, Nes Ziyyona.
R. Fass, Y. Straussman, A. Shahar, and A. Mizrahi.
Applied and Environmental Microbiology, Vol 39, No 1, p 227-232, January, 1980. 1 Fig, 4 Tab, 16 Ref.

Descriptors: *Water treatment, *Viruses, Purification, Drinking water, Potable water, Wastewater, *Silicates, Bacteriophages, Adsorbents.

Commerically available amorphous silicates having small size particles, large surface areas, and high adsorption capacity for organic compounds were investigated as virus adsorbents. The T4 bacteriophage was used in this study as a model due to its well-defined morphology and its stability towards agitation and temperature changes, as well as due to the availability of a convenient assay. Amorphous silicates were found to have a high nonspecific adsorption capacity for T4 bacteriophage, representing a promising tool and a model for purification of water from viral contamination. Investigations with Escherichia coli T4 bacteriophage showed adsorption capacity of up to 99.9% on different tested silicates. Optimal conditions for the adsorption of T4 bacteriophage on various commercially available silicates were determined. A continuous-flow adsorption of T4 bacteriophage on silicates appears to represent a model system for the removal of viruses from potable water and sewage. (Baker-FRC)
W82-00350

**FIELD EVALUATION OF A SWIRL DEGRITTER AT TAMWORTH, NEW SOUTH WALES, AUSTRALIA,**
G. J. Shelley, P. B. Stone, and A. J. Cullen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-187247, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-063, June 1981. 6 p, 2 Fig, 5 Ref.

Descriptors: *Water treatment, *Suspended solids, Field tests, *Pretreatment of water, Suspended load, Particle size, Flow rates, Cost analysis, Hydraulic engineering, Construction costs, Operating costs, Maintenance costs, New South Wales, *Australia.

The overall objective of this field evaluation program was to provide information on the behavior of a full-scale swirl degritter designed and constructed in accordance with the shapes and proportions developed during model studies. The swirl degritter was designed to pretreat river water before it enters into the rising main in order to reduce wear and tear on the raw water pumps and also to reduce the solids loading of the rising main and that of the balance tank of the water treatment works. Results of the solids removal had been evaluated in terms of three parameters: solids larger than 0.2 mm (the classical size aimed at in grit chambers); solids larger than 0.088 mm; and total settleable solids. In general, the tests proved the validity of the laboratory results, and at design flowrates, 98% removal efficiencies were achieved. Tests at flowrates higher than the design showed slightly better efficiencies than predicted. The field evaluation tests carried out at Tamworth, New South Wales, Australia, prove the validity of the system in terms of its hydraulic efficiency. When compared with a conventional, constant-velocity, longitudinal flow grit chamber, the construction cost is halved and operation and maintenance costs are considerably lower. (Author's abstract)
W82-00376

**EFFECTIVENESS OF ACTIVATED CARBON FOR REMOVAL OF TOXIC AND/OR CARCINOGENIC COMPOUNDS FROM WATER SUPPLIES,**
Michigan Univ., Ann Arbor.
W. J. Weber, Jr., and M. Pirbazari.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-187197, Price codes: A17 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-057, June 1981. 9 p, 11 Fig.

Descriptors: *Water treatment, *Activated carbon, Adsorption, Chlorinated hydrocarbons, Humic acids, Organic matter, Model studies, Biological degradation, Water supply, *Toxins, *Carcinogens, Magnesium, Calcium, Polychlorinated biphenyls, Benzenes, Dieldrin, Carbon tetrachloride.

Equilibrium, rate and continuous long-term adsorption studies were conducted for humic acids at raw water background concentrations and for carbon tetrachloride, benzene, two commercial mixtures of PCB's, dieldrin, and p-dichlorobenzene at representative trace concentration levels. Experimental breakthrough profiles were developed for each of the trace compounds alone and in the presence of background humic acid solutions to investigate competitive and/or chromatographic effects. The results indicate that trace compound adsorption is generally affected adversely by background organic matter. The adsorption capacity of activated carbon for humic substances was markedly enhanced by the presence and concentration of several common constituents of water supplies, including Mg and Ca ions. There was evidence from the work that enhanced removal of humic substances might also provide for more effective removal of associated organic molecules - such as PCB's and dieldrin - in water treatment operations. The Michigan Adsorption Design and Applications Model (MADAM) was generally able to simulate and predict the performance of fixed-bed adsorbers to remove the compounds investigated in the absence of the humic acids. With the strictly adsorption version of MADAM, reliable predictions were difficult because of the prolific biological growth in the adsorbers that received the humic acids. For such cases, biological degradation dynamics must be incorporated in the model. The single-solute version of MADAM was able, however, to simulate/predict independent pilot data provided by the EPA about the adsorption of 1,2-dichloroethane in the presence of naturally occurring background organics in Ohio River water. (Brambley-SRC)
W82-00383

**UPFLOW WATER FILTRATION UNIT, TEST RESULTS,**
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
C. E. Rice, M. L. Magnuson, and J. E. Garton.
Transactions of the ASAE, Vol 23, No 5, p 1143-1146, October/November, 1980. 5 Fig, 5 Tab, 5 Ref. OWRT-A-060-OKLA(2), 14-34-0001-6037.

Descriptors: *Water purification, *Filtration, Upflow filtration unit, *Rural areas, Turbidity, Domestic water, Farm ponds, Water supply, *Home-operated filter systems.

A rural homeowner-operated water filtration system for purifying surface waters and water from farm ponds was tested. Two different upflow-type water filtration and treatment units were compared. The large automatic unit (3 feet X 7 feet tank) included chemical feeder pumps and storage tanks for alum and chlorine, a pump and tank for pressurized-treated water, and liquid level controls. Filter medium was hydrous aluminum silicate. At a flow rate of 92 liters per min per square meter of filter area, this unit produced finished water at a rate of 16 gallons per minute with a turbidity of 2 NTU or less. This unit is large enough to supply the water needs of several households. The small unit (tank 1 x 1 x 5 feet) produced 414 gallons per day at a low rate of 1.15 gallons per minute for 15 minutes each hour. Alum concentrations were critical for proper results, frequent back flushing of the filter was required, and a water storage unit was necessary. Neither system clarified water with turbidity of 80 NTU or greater without pretreatment. (Cassar-FRC)
W82-00407

**OZONE TREATMENT OF POTABLE WATER - PART I,**
C. Nebel.
Public Works, Vol 112, No 6, p 86-90, June, 1981. 7 Fig, 4 Tab, 27 Ref.

Descriptors: Ozone, *Ozonation, *Water treatment, *Water purification, *Potable water, Domestic water, Drinking water, Taste, Odor control, Disinfection, Bacteria, Chlorination, Chemical treatment, Organic compounds, Heavy metals.

The use of ozone for treating drinking water is discussed. Ozone oxidizes organic pollutants and has the ability to act as a sterilant. It increases the characteristics of settleability, removal of organic compounds causing tastes, odors, and color, destruction of algae, and oxidation of iron, manganese, and heavy metals. The dosage level required for disinfection depends largely upon the amount of organic material present as well as the bacteria count. Heavy metals which can be controlled by ozone oxidations include lead, zinc, cadmium, and nickel. No solubility reductions can be expected for barium or calcium, since they have only one oxidation state. (Titus-FRC)
W82-00451

**OZONE TREATMENT OF POTABLE WATER--PART 2,**
C. Nebel.
Public Works, Vol 112, No 7, p 68-71, July, 1981. 5 Fig, 11 Ref.

Descriptors: *Ozone, *Organic compounds, *Disinfection, *Water treatment, Chlorinated hydrocarbons, *Trihalomethanes, Potable water, Ozonation, Chloroform, Coagulation, Humic acids, Activated carbon, Oxidation, Chlorination.

Part 2 of this paper discusses the role of ozone in oxidation of organic compounds and in the control of trihalomethanes (THM) in water treatment. Ozonation of dissolved organic materials yields polar and charged molecules which are more easily removed by alum coagulation. Those compounds readily oxidized include phenolics, detergents, pesticides, chemical manufacturing wastes, humic acids, polycyclic aromatic hydrocarbons, proteins, and amino acids. Formation of THM's in treated water may be controlled by ozonation. Of 80 water supplies surveyed, the only ones with no trace of THM's were produced by treatment facilities using ozone as a unit process. Although there are methods for preventing or removing THM's or their precursors, ozonation is less expensive and more effective than most of the others. Ozone may be added at the front of the plant to increase organics removal by alum flocculation, at the end of the treatment process for removing humic acids and other dissolved organics, or by combining ozone-activated carbon in the biological activated carbon process (BAC). Some of the BAC units have operated for six years without the need for reactivation. Ozone dosage levels are in the range of 1.5-4 mg per liter. Ozone as the only disinfectant can rarely be applied because the system to be treated must meet the following criteria: (1) dissolved organic content low enough to provide little food for bacteria, (2) low water temperature, (3) clean, high quality distribution system with low residence time, and (4) no ammonia. (Cassar-FRC)
W82-00452

**CHLORINATED DRINKING WATER,**
C. A. Stewart, Jr.
Science, Vol 212, No 4499, p 1086-1087, June 5, 1981.

Descriptors: *Drinking water, *Chlorination, *Carcinogens, *Chloroform, Water treatment, Public health.

This letter to the editor discussed the suggestion that the presence of chloroform in drinking water may pose a public health risk. While it may be reasonable to conclude that chloroform might be a human carcinogen on the basis of test with rats and mice, it is not appropriate to conclude that chloroform is a human carcinogen. Occupational health standards indicate that exposures in the range of 0.1 to 10 grams per day pose a health risk. On the other hand, the exposure to chloroform from drinking water is 0.1 to 10 grams per lifetime. These data indicate that the number of excess cancers attributable to chloroform in drinking water is exceedingly small. The wide range of factors associated with the decision of to chlorinate water which have also been associated with cancer risk raises questions regarding any conclusion that increases in certain types of cancer are attributable to water chlorination. Finally, even if a clear association could be demonstrated, the question of whether the water was hazardous because it was chlorinated or chlorinated because it was hazardous would remain. (Carroll-FRC)
W82-00467

**WATER TREATMENT MODEL FOR POLLUTANT EXPOSURE ASSESSMENT,**
Environmental Protection Agency, Athens, GA.
K. F. Hedden.
Journal of Environmental Science and Health, Part A, Vol 15, No 4, p 285-305, 1980. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Organic compounds, *Risks, *Assessments, *Model studies, *Water treatment, Activated carbon, Public health, Sedimentation, Coagulation, Flocculation, Filtration, Aeration, Chemical oxygen demand, Chemical wastes, Water pollution prevention, Effluents, Polyaromatic hydrocarbons, Carcinogens, Insecticides.

This paper describes a model of municipal water treatment processes for use in predicting the degree of removal of a toxic substance. Under the Toxic Substances Control Act, this information must be provided before new chemicals may be marketed. The subroutines include sedimentation, coagulation-flocculation (2 versions), filtration, aeration (2 versions), chemical oxidation, and granular activated carbon adsorption treatment. The chlorination model needs further experimental data and, in all probability, chemicals will need to be modeled on an individual basis. If the number and distribution of the population at risk and the necessary human and toxicological data are available, the potential health hazards of exposure to a chemical can be assigned. A sample run shows the removal rates for 11 selected chemicals: p-cresol, quinoline, methyl parathion, benzothiophene, 9H-carbazole, benzoquinoline, dibenzothiophene, 7H-dibenzocarbazole, benzoanthracene, benzopyrene, and mirex. (Cassar-FRC)
W82-00500

## 5G. Water Quality Control

**QUARTERLY PROGRESS REPORT, NATIONWIDE URBAN RUNOFF PROGRAM.**
Woodward-Clyde Consultants, San Francisco, CA.
Environmental Protection Agency Report, April 1980. 64 p, 3 Fig, 5 Tab, Append.

Descriptors: *Urban runoff, *Water quality control, *Water pollution control, Economic aspects, Pollutants, Water pollution treatment, Planning, Monitoring, Water use.

The progress and status of the Nationwide Urban Runoff Program for the first quarter of 1980 are summarized. Of the thirty prototype projects, ten are well underway and are yielding results, ten have approved work plans and adequate staffing, nine have submitted work plans which await approval, and one is still drafting a work plan scope. In fiscal year 1979 the projects spent a total of $6.22 million. Progress in each of the ten major tasks - program development, program management, 208 urban runoff status determination, agency program coordination, prototype project selection, work plan development, technical/management assistance, project monitoring/coordination, program assessment and evaluation, and nationwide assessment and report to Congress - is recorded. The appendix indicates the grantee, location, key staff, receiving waters, beneficial uses, suspected pollutants, impacts, candidate BMP's, budget, grant amount and status, project status, and problems, for each project. (Brambley-SRC)
W82-00044

**WQM FIVE YEAR STRATEGY (FY 81-BASELINE).**
Environmental Protection Agency, Washington, DC. Water Planning Div.
Report, January 1980. 62 p, 2 Fig, 5 Tab, 20 Ref, 3 Append.

Descriptors: *Water quality management, *Long-term planning, *Legislation, *Management planning, Information systems, Nonpoint pollution sources, Monitoring, Water quality standards, Water treatment facilities, Runoff, Groundwater pollution, Financing.

The purpose of this strategy is to provide long-range direction for the water quality management (WQM) program to assist EPA Regions, States, areawide agencies, and the participating public with program planning in fiscal year 1981 and beyond, and to provide descriptions of program needs and directions. The focus is on WQM activities defined by sections 106, 208, and 303(e) of the Clean Water Act. The three highest management priorities for the program in FY 81-85 are improved program management, completion of the 208 grant program, and building and transferring an information base for nonpoint source control. Program priorities for the states include management of publicly-owned treatment works, monitoring, permits and enforcement, water quality standards, emergency responses, and nonpoint source management. The national 208 priorities are nonpoint source problems with the greatest emphasis on urban storm runoff, agriculture, and ground water contamination. Funding projections are made, based on historical data. The trend is to reduce federal funding with state and local agencies providing more funding. Four emerging policy issues are: coordination of 106 and 208 grants; water quality, quantity, and conservation; coordination of 201 and 208 programs; and coordination of WQM and other agency ground water activities. (Brambley-SRC)
W82-00045

**SELECTIVE OVERBURDEN PLACEMENT,**
Bureau of Mines, Spokane, WA. Spokane Research Center.
G. G. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-135055, Price codes: A05 in paper copy, A01 in microfiche.
In: Surface Coal Mining Reclamation Equipment and Techniques, Proceedings: Bureau of Mines Technology Transfer Seminars, Evansville, IN, June 3, 1980, and Denver, CO, June 5, 1980. Bureau of Mines Information Circular 8823, 1980. p 54-59, 2.

Descriptors: *Water pollution control, *Ground water, *Coal mines, *Strip mines, Leaching, Trace metals, Mine wastes, Spoil disposal.

The current practice of identifying toxic ions of salts and trace metals at surface coal mining sites involves drilling on a 1 mile grid in unfaulted areas and on a 1/2 mile grid in faulted areas. Based on a study of a 100 acre premine site, a two-step drilling program is proposed. The overburden should be drilled on a 1/2 mile grid to identify which physiochemical parameters exist in inhibitory concentrations. Then the site should be drilled on a 100 to 200 foot grid to identify the extent of those parameters. It is desirable to suppress the leaching process in the presence of spoil containing inhibitory concentrations of trace metal or salts. This may be done in four ways: sealing with an impermeable layer; dilution through mixing; use of a topographic dome to divert surface water; and subsurface water can be consumed by plantlife. Clay capping was found to be effective as a barrier to saturated flow. Mixing of inhibitory spoil material with other clean spoil tends to dilute the concentration of inhibitory material to acceptable levels. A network of monitoring wells were placed in the overburden and spoil in a coal mine in Colstrip, southeastern Montana. Water levels and water quality measurements were taken. Data suggest that mining activities have had little effect on the overburden water levels at distances greater than 2,000 ft from the mine pit. No major changes in water quality have occurred owing to commercial mining at the site. (Moore-SRC)
W82-00053

**METHOD AND APPARATUS FOR POLLUTANT SPILL CONTROL,**
J. E. Turbeville.
U.S. Patent No. 4,234,420, 18 p, 7 Fig, 46 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 1105, November 18, 1980.

Descriptors: *Patents, *Oil spills, *Oil pollution, Water pollution treatment, Water quality control, Adsorption, Equipment, *Water pollution control, Magnetic particles, Hydrocarbons.

Organic pollutant spills on aquatic bodies may be collected by a method comprising distributing buoyant magnetically susceptible, olephillic, hydrophobic, resilient sorbent particles on the surface of the pollutant, allowing the sorbent to attract and bind the pollutions, magnetically collecting the pollutant-bound surbent particles, compressing the pollutant-bound sorbent particles to expel the pollutant to a pollutant sump, allowing the compressed sorbent particles to recover from compression, and redistributing the sorbent particles on the surface of the remaining pollutant. An apparatus for the practice of the pollutant collecting method may be fabricated as a surface going aquatic vessel. (Sinha-OEIS)
W82-00056

**MEANS AND METHOD FOR SWEEPING MATERIAL FLOATING ON WATER USING VIBRATIONAL ENERGY,**
Ocean Ecology Ltd., Edmonton (Alberta). (Assignee).
J. N. Koblanski.
U.S. Patent No. 4,235,711, 6 p, 5 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 4, p 1530, November 25, 1980.

Descriptors: *Patents, *Water quality control, *Water pollution treatment, *Oil pollution, *Oil spills, Acoustics, Sound waves, Vibrations, Equipment.

An apparatus for sweeping contaminating material such as oil along the surface of a body of water uses acoustic waves as a propelling force. The vibrational waves are produced by a device supported below the water surface and aimed upwardly towards a peripheral edge of the oil spill. Vibrational waves generated when the device is activated strike the air above the water surface and as a result are compacted into a flattened and horizontally elongated zone of vibrational energy which exerts a driving force on the oil spill edge. The method uses acoustical energy to provide, in effect, a huge broom which can be wielded to sweep floating oil or the like into a confined area from where it can more readily be picked up by other means. (Sinha-OEIS)
W82-00062

**PROCESS FOR REMOVING ALKALINITY AND HARDNESS FROM WATERS,**
Water Refining Co., Inc., Middletown, OH. (Assignee).
For primary bibliographic entry see Field 5F.
W82-00063

**THE HORSE CREEK BASIN PROJECT,**
Davis and Floyd Engineers, Inc., Greenwood, SC.
E. I. Davis, and W. J. Day.
Water/Engineering and Management, Vol 128, No 5, p 90, 92, 95, May, 1981. 2 Fig, 2 Tab.

Descriptors: *Wastewater facilities, *Regional planning, *Stream pollution, Pipelines, Industrial wastes, Natural streams, Water pollution sources, Water treatment, Horse Creek Basin, South Carolina.

Water treatment plans for the grossly polluted Horse Creek Basin and its major tributaries were designed to meet Environmental Protection Agency requirements. Construction and operation of a single regional plant which used an extended aeration-type wastewater treatment system was planned. Construction of the plant and the trunk system to collect the water to be treated began in 1977. The longest trunk line was 12 miles long, with the first three miles being a force main. One industry discharged alkaline waste into the stream, while another discharged a high pH waste. Unlined concrete pipe was used for the system. The project was completed in 1980 and the Horse Creek has already returned to a multiple-use waterway. The project has permitted development of a once blighted area. (Small-FRC)
W82-00071

**BASIN MANAGEMENT IN THE SAN BERNARDINO VALLEY,**
East San Bernardino City Water District, CA.
For primary bibliographic entry see Field 4B.
W82-00075

**PREDICTING RUNOFF POLLUTANT REDUCTION IN BUFFER ZONES ADJACENT TO LAND TREATMENT SITES,**
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W82-00141

**ENVIRONMENTAL PLANNING FOR COAL STRIP MINING,**
Loxton, Hunting and Associates, Gaberone (Botswana).
A. C. Venn, V. C. Barnes, N. Boegman, G. H. Grange, and J. F. V. Phillips.
Civil Engineer in South Africa, Vol 22, No 4, p 96-100, April, 1980. 1 Ref.

Descriptors: *Coal mining, *Water pollution control, Mining, Mine wastes, Acid mine drainage, Mine drainage, Acid streams, Planning, *South Africa.

Environmental planning and care of coal mining areas is viewed against the background that coal mining is a vital component of the national economy of South Africa. In general coal mining produces three water pollution problems: chemical pollution due to the well known pyrite oxidation reaction, which produces sulfuric acid and iron salts; washaways of coal slurry or coal fines which can produce serious suspended solids problems in

water, cause an oxygen demand, and lead to minor chemical pollution; and increases in the normal load of suspended solids which are more or less inert due to erosion of disturbed soil. The severity of these problems depends on locality with respect to rainfall surface water and underground water. Mining close to a river or stream creates specific problems in the prevention of pollution. The pyrite content of coal, the general slope of the workings, the method and direction of mining, and the method and degree of rehabilitation of the area attained after mining must also be considered. Current policies to attain a good degree of pollution control include the control of storm runoff, prompt removal of water from open-cast workings, arranging drains and sumps for rapid collection of groundwater, diversion of rivers, and control of seepage into and from open cast workings. Proper rehabilitation of the site is probably the most effective means of preventing water pollution from open-cast mining operations. (Baker-FRC)
W82-00214

**GRAPHICAL EFFLUENT QUALITY CONTROL FOR COMPLIANCE MONITORING: WHAT IS A VIOLATION,**
Illinois Environmental Protection Agency, Springfield.
D. J. Schaeffer, K. G. Janardan, H. W. Kerster, and M. S. Shekar.
Environmental Management, Vol 4, No 3, p 241-245, May, 1980. 1 Fig, 9 Ref.

Descriptors: *Sampling, *Effluent standards, *Regulations, Graphical methods, Monitoring, Water quality control, Water pollution control, Water sampling, Pollutant identification, Mathematical studies.

A graphical method is suggested to determine the mean value for compliance or non-compliance with pollutant discharge regulations. This avoids the problems of a too-narrow or too-wide allowable variation by eliminating 10% of the results from consideration. This proposed change would effectively double the allowable operating mean and the daily excursion point. Both regulators and dischargers would have a clear definition of satisfactory operation and multiple criteria (numerical compliance, expected variability, frequency, and magnitude of violations) for scoring compliance. Either composite or grab samples may be used. (Cassar-FRC)
W82-00261

**STRATEGY FOR RADIOACTIVE WASTE DISPOSAL IN CRYSTALLINE ROCKS,**
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5E.
W82-00299

**DETERMINATION OF MARINE CONSENT CONDITIONS,**
Clyde River Purification Board (Scotland).
D. Hammerton, A. J. Newton, and R. Allcock.
Effluent and Water Treatment Journal, Vol 20, No 6, p 261-262, 265-266, 269, June, 1980. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Water pollution control, *Effluent standards, *Industrial wastes, Tidal rivers, Ecological effects, Water pollution effects, Stevenston, Scotland.

A case study of the development of consent conditions for a large ICI organics and explosives complex at Stevenston, Scotland, is presented. This facility discharges a variety of pollutants from manufacture of nitroglycerine, nitrocellulose, pentaerythritol tetranitrate, silicone oils, ammonium nitrate, lead styphnate, and dyestuff intermediates. The original design was to discharge all effluents 2 km at sea. However, the 12 million pound cost estimate caused a modification of the system. Two of 10 existing Garnock River outfalls and 2 short sea outfalls would be retained, with a long sea outfall to be constructed. Since effluent and storm water is combined, sensors will monitor overflows. A table lists the agreed limits for flow and other parameters. (Cassar-FRC)
W82-00323

**ROCKY MOUNTAIN PIPELINE PROJECT: ENVIRONMENTAL IMPACT STATEMENT,**
Bureau of Land Management, Washington, DC.
G. R. Konwinski, and W. N. Palmquist.
Available from the National Technical Information Service, Springfield, VA 22161 as DE81-026112, Price codes: A07 in paper copy, A01 in microfiche. Federal Energy Regulatory Commission, Office of Pipeline and Producer Regulation Report FERC/EIS-0024, TIC 92, July 1981. 59 p, 6 Fig, 3 Tab, 9 Ref, 1 Append.

Descriptors: *Environmental impact statement, *Environmental effects, *Construction, *Pipelines, Groundwater, Flood plains, Sediments, Stream pollution, *Water pollution prevention, Sediments, Intermittent streams, Streambeds, *Rocky Mountain Pipeline Project, Planning, *Erosion control, Sediment transport, Forecasting.

The Rocky Mountain Pipeline Project (RMPP) is a proposed 610-mile long natural gas transmission system. The RMPP would potentially cross many intermittent and perennial streams. The major concern with a pipeline stream crossing is the disruption of the streambed and the increase in sediment movement. The distance that the construction-induced sediment would be transported depends upon construction techniques, the stream flow parameters, and the grain size distribution of the stream bed materials. The disturbance of the streams cross section and the increase in sediment would be short term (3 to 5 days). It is expected that the levels of contaminants, such as lubricants and fuels introduced by construction into the waters that are crossed, will exceed state standards for short distances downstream, and mixing will be rapid. At some stream, road, and utility crossings and in some other topographically low areas, ground water may be encountered, but effects on groundwater would be localized and temporary. The proposed pipeline system would cross a floodplain at every stream crossing, but no aboveground permanent facilities would be constructed within a 100-year floodplain. Since regulations require that the pipeline be buried below the maximum scour depth, there would be no effects on flood stage. The pipeline will be hydrostatically tested in sections. The test water will be discharged in an environmentally acceptable manner. (Moore-SRC)
W82-00394

# 6. WATER RESOURCES PLANNING

## 6A. Techniques Of Planning

**CONCEPTUAL DESIGN OF A REGIONAL WATER QUALITY SCREENING MODEL,**
Argonne National Lab., Argonne, IL.
M. J. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/10151-T1, Price codes: A04 in paper copy, A01 in microfiche. Dept. of Energy Report DOE/EV/10154-T1, Jan, 1981. 57 p, 2 Fig, 7 Tab, 25 Ref, Append.

Descriptors: *Water quality, *Model studies, *Water pollution effects, *Model studies, Regional analysis, Environmental effects.

Various energy-related activities may result in water quality impacts of varying degrees of severity. There is a need for an improved capability to identify regions where negative impacts may occur. The purpose of this report is to present the background information and the conceptual basis needed for the design of a regional water quality screening model with such a capability. The model is intended for use in the Strategic Environmental Assessment System (SEAS) and also for use in assessments of water quality impacts in efforts such as the Regional Issue Identification and Assessment (RIIA) program. The proposed water quality model does not predict instream concentrations of pollutants for the present; measured concentrations are used to account for present conditions. The model does provide projections of future instream conditions based on some scenario for energy development and is intended for use in screening for potential problem areas. The model will allow existing flow and background concentration information for the Aggregated Sub-Area level to be used for studies at that scale. It will also allow smaller-scale studies to be done. The proposed model has a number of limitations: the neglect of localized effects having a spatial scale much smaller than that of the minimum spatial units used; the neglect of inputs from certain sources of water pollution; and the use of a simplified treatment of pollutant behavior. (Moore-SRC)
W82-00038

**COMPUTER MODELING OF FLUID FLOW DURING PRODUCTION AND ENVIRONMENTAL RESTORATION PHASES OF IN SITU URANIUM LEACHING,**
Bureau of Mines, Twin Cities, MN. Twin Cities Research Center.
R. D. Schmidt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-160236, Price codes: A05 in paper copy, A01 in microfiche. Report of Investigations 8479, 1980. 72 p, 16 Fig, 1 Tab, 16 Ref, 4 Append.

Descriptors: *Computer models, *Leaching, *Groundwater movement, *Injection wells, Flow characteristics, Model studies, Groundwater pollution, *Uranium, Extraction, Pumping, Aquifers, Hydrologic models.

In situ leaching is one method that shows promise of being both economically and environmentally advantageous for extraction of uranium from low-grade ore deposits. This computer model is intended to describe the flow behavior of leachants and ground water during the development, production, and restoration phases of a leaching operation involving an arbitrary pattern of injection and recovery wells. The model enables an assessment of the effectiveness and acceptability of various well and pumping configurations, in terms of both fluid dispersion within the ore pod and fluid excursions into the surrounding aquifer. Different aquifer environments are modeled, using a closed-form solution to the partial differential equation that describes three-dimensional changes in piezometric head as a result of pumping from leachant injection and recovery wells. The computer program can model a maximum of 50 arbitrarily located wells. Numerical techniques involving difference quotients and Taylor expansions about time points are used to derive time, velocity, areal sweep, and fluid volume parameters associated with leaching hydraulics. These parameters are output by the program in graphic and tabular formats. (Moore-SRC)
W82-00043

**WATER SUPPLY AND DEMAND IN AN ENERGY SUPPLY MODEL,**
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 6D.
W82-00050

**PLANNING STUDY TO MODEL AND MONITOR COAL PILE RUN-OFF,**
TRC Environmental Consultants, Inc., Wethersfield, CT.
G. T. Brookman, J. A. Ripp, P. B. Katz, B. C. Middlesworth, and D. K. Martin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-152530, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S7-81-016, July 1981. 5 p, 3 Fig, 1 Tab.

Descriptors: *Coal, *Surface runoff, *Hydrologic models, *Water pollution prevention, Runoff models, *Runoff forecasting, Pollution load, Catchment areas, Water quality control, Precipitation, Infiltration, Erosion, Oxidation, Path of pollutants, *Coal pile runoff.

A model has been developed to aid in the prediction of the quantity and quality of coal pile runoff from utility sites. Quantitative data such as precipi-

tation, runoff/infiltration, percolation, snow-melt, and infiltration into ground water, are used in a hydrological model TRCH2O, and qualitative data such as pyrite oxidation, freeze/thaw of coal, gully erosion, and pollutant wash-off, are used in a qualitative model TRCCOAL. Output from TRCH2O combined with site specific data for TRCCOAL simulates the daily, monthly, and annual run-off flows and loadings of pollutants such as acid, iron, sulfate, and trace metals. A field program for model validation will be conducted. Once validated the model can be used in the design of runoff collection basins and treatment systems, with the object of achieving site-specific designs, rather than the current arbitrary designs. (Brambley-SRC)
W82-00091

**WATER POLLUTION POTENTIAL OF COAL-SLURRY PIPELINES,**
Montana State Univ., Bozeman, Dept. of Civil Engineering and Engineering Mechanics.
H. S. Peavy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-187221, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S7-81-082, June 1981. 6 p, 2 Fig, 6 Tab.

Descriptors: *Coal, *Slurries, *Pipelines, *water pollution sources, *Chemical reactions, Hydrogen ion concentration, Minerals, Dissolved solids, Turbidity, Organic carbon, Alkalinity, Colloids, Planning.

Coal-slurry pipelines have been proposed as one economical means of transporting coal over long distances to specific markets. The objective of this research project was to characterize those contaminants associated with transport waters from coal-slurry pipelines. This was accomplished through tests using a rotating bench-scale reactor. Tests consisted of coal mixed with tap water, tap water with additives, synthetic saline water, and synthetic saline water with additives. Tests were performed for a period of 12 days each. The results indicate that chemical interactions do occur between water and coal-slurry pipelines. There was a decrease in pH of approximately two units (from approximately 8 to approximately 6). Dissolution of metals at a pH of 6 was not significant. An increase in mineral content of fresh water was observed. Alkalinity, total dissolved solids (as indicated by electrical conductivity), and sulfates each showed increases. Use of phosphorus-based chemical additives for corrosion control resulted in substantial concentrations of phosphate. Turbidity remained in the water after separation of the coal by centrifugation. Although some color may be present as a result of humic acids and manganese, colloidal particles appeared to be the main cause of turbidity. Dissolved organic carbon levels may be significant if reuse (either prior to or after discharge) requires chlorination. These organics are potential percursors of chlorinated hydrocarbons. (Brambley-SRC)
W82-00096

**WATER, ENERGY AND LABOR REQUIREMENTS FOR FUTURE PACIFIC NORTHWEST IRRIGATION,**
Oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
L. D. King, and M. L. Hellickson.
Transactions of the ASAE, Vol 24, No 3, p 691-698, May/June, 1981. 8 Fig, 1 Tab, 14 Ref.

Descriptors: *Irrigation, *Planning, *Computers, Model studies, Costs, Economic aspects, Agriculture, *Pacific Northwest, Energy, Labor.

A computer model was developed to determine future water, energy and labor requirements for three projected levels of irrigation development. Irrigation systems were selected by minimizing irrigation costs by crop for each of 45 hydrologic basins in the region. Results indicate that per acre energy requirements will increase rapidly as per acre water and labor requirements decrease. The study area was located in the Pacific Northwest. Data collected included levels of irrigation development, water, energy, labor cost and trends, and capital investment of irrigation systems; irrigation system labor requirements, expected useful system life, and estimated changes in irrigation efficiency. Pump-back and similar technologies at present offer the possibility of both increasing application efficiency and conserving energy. However, they have the disadvantage of a high labor requirement. The relationships between applying water in quantities greater than required for crop consumption and late season in-stream flow augmentation and/or aquifer recharge are not well understood. However, they should be investigated before major changes are made in regional water-energy management schemes. (Baker-FRC)
W82-00143

**FLOW RESISTANCE IN VEGETATED WATERWAYS,**
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W82-00152

**THE LIMITATIONS AND USEFULNESS OF STREAMFLOW GENERATION METHODS: A CASE STUDY,**
Saskatchewan Univ., Saskatoon. Dept. of Civil Engineering.
W. J. Stolte.
Canadian Journal of Civil Engineering, Vol 7, No 1, p 185-191, 1980. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Reservoir design, *Streamflow forecasting, *Probabilistic process, Design criteria, Dams, Red Deer River, *Alberta, Model studies, Stochastic process, Hydrology, Statistical analysis, Case studies.

The increasing complexities of probabilistic models have made the connections between models and the physical world more and more vague. As a result, engineering judgement tends to be deemphasized. The models' validity is assumed even when practical verification must await future events. Results of generated streamflow sequences for the dam and reservoir being constructed on the Red Deer River, Alberta were compared with 61 years of recorded data. Both a simple autoregressive model and a more complex autoregressive moving average model had similar deficiencies. The generated and recorded peak monthly flows and minimum flows were comparable, but the generated sequences reached minimum levels faster than did actual flows. The value of stochastic streamflow generation lies in predicting reservoir storage failure. However, it is not so reliable as recorded data as a basis for hydrologic design of reservoirs. (Cassar-FRC)
W82-00229

**BASIN MANAGEMENT IN THE SAN BERNARDINO BASIN AREA,**
San Bernardino Valley Municipal Water District, CA.
L. W. Rowe.
Ground Water, Vol 18, No 6, p 626-629, November-December, 1980.

Descriptors: *Management planning, *Drainage basins, *Computer applications, Hydrologic data, Monitoring, Project planning, Economic aspects, Data interpretation, Rainfall, Watersheds, Groundwater, Water supply, Pumps, *San Bernardino Valley, California, *Watershed management.

The San Bernardino Valley Municipal Water District was formed in 1954 to master plan the long-term water supply, including the importation of supplemental water for a portion of the Upper Santa Ana River Basin. As part of its function, the District has established a hydrologic data base. Development and selection of the alternative strategies is more effective with historic and real time hydrologic data. The updating of the operation economics associated with importation also benefits from availability of hydrologic data. Water quality data is obtained through an ongoing monitoring program. Eight service areas within the District investigate the feasibility of introducing supplemental water, either through groundwater recharge or direct filtration, to augment native supplies. Groundwater models are used in the development of management practices. The Cooperative Water Project is an arrangement between public and private water purveyors which provides a system for exchanging water credits during periods of short supply. The District also identifies excess pumpage and wheeling capacity within existing water systems, and engages in regional public participation programs. (Titus-FRC)
W82-00280

**GROUND-WATER MODELING: RECENT DEVELOPMENTS,**
GeoTrans, Inc., Reston, VA.
For primary bibliographic entry see Field 2F.
W82-00281

**THE CONSULTANT'S VIEWPOINT ON ALTERNATIVE DISINFECTANTS,**
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
M. L. Tittlebaum, J. L. Pavoni, B. F. Maloy, and T. L. Kochert.
Public Works, Vol 111, No 1, p 40-41, January, 1980. 1 Fig, 6 Ref.

Descriptors: *Disinfection, *Chlorination, *Decision making, Planning, Wastewater treatment, Residual chlorine, Aquatic life, Public health, Toxicity, Chlorinated hydrocarbons, Environmental effects, Water quality.

A decision-making tree for choosing wastewater disinfection alternatives is described. High priority is given to water quality and environmental effects, in particular, eliminating hazards from pathogens and halogenated organic compounds and protecting aquatic life from residual chlorine toxicity. Possible disinfection methods include chlorine, chlorine dioxide, ozone, ultraviolet radiation, bromine chloride, and dechlorination. However, most of the disinfectants currently being considered for wastewater treatment have serious limitations, so potential applications must be considered on a case-by-case basis. (Cassar-FRC)
W82-00286

**DEVELOPMENT OF A RURAL WATER DISTRICT,**
Corlew (M. B.) and Associates, Inc., Edwardsville, IL.
P. M. Corlew, and G. F. Harris.
Public Works, Vol 112, No 5, p 86-87, May, 1981. 1 Fig.

Descriptors: *Rural areas, *Water distribution, *Water treatment facilities, Water demand, Water treatment, Water supply systems, Water conveyance, Pipelines, Water mains, Water use, Water shortage, Farms, *Madison County, Illinois.

A successful rural water district plan was developed in Madison County, Illinois with the aid of Farmers Home Administration (FmHA) funding. The design of the total water system, which would provide water to drought-stricken farms previously supplied by wells, included 78 miles of water main, an elevated and a ground storage tank, two booster pump stations, telemetry and appurtenances. The project was built to handle 550 users with a 35% growth factor. The city of Edwardsville contracted to supply one million gallons of water per month to the Northeast Central County Public Water District (NCCPWD) in turn for monies to help upgrade their current treatment facility. The operations of the new NCCPWD system are diagrammed, and special provisions for large family dwellings and pipeline safety when laid beneath roadways are discussed. Early installation of house services allowed the district to receive revenue from the project six months prior to its completion in July of 1980. The director of the FmHA attributes the success of this water district project to the accurate assessment of water demand, the capability and flexibility of the contractor, the close communication between the Board of Trustees and residents, and the project's

innate designs to easily accommodate expansion. Total cost of the project was about $3 million, of which a little less than $1.4 million was borrowed. (Geiger-FRC)
W82-00288

**NORTHEASTERN NEW JERSEY GRAPPLES WITH A DROUGHT,**
New Jersey Dept. of Environmental Protection, Trenton.
For primary bibliographic entry see Field 8A.
W82-00289

**THE WORLD CLIMATE PROGRAMME,**
Bureau of Meteorology, Melbourne (Australia).
J. W. Zillman.
Search, Vol 11, No 4, p 108-111, April, 1980. 11 Ref.

Descriptors: Water resources, *Climatology, Planning, *Weather, *World Meteorological Organization, World Climate Program, Decision making, Water policy, International commissions.

The World Meteorological Organization established the World Climate Program in May 1979 as an international effort to foresee climatic changes and to use this knowledge in planning and management of man's activities. The Climate Study Program, one of the four components of the overall program, will concern formulation of rational policy alternatives in agriculture, water resources, ocean resources, fisheries, land use, etc. The Program will be operating on time scales from several weeks to several decades and on space scales from regional (1000 km) to global. (Cassar-FRC)
W82-00317

**A NEW ERA FOR CHINA'S HYDROPOWER,**
Manitoba Univ., Winnipeg. Dept. of Geography.
For primary bibliographic entry see Field 8A.
W82-00335

**CHINA'S POTENTIAL FOR HYDRO DEVELOPMENT,**
For primary bibliographic entry see Field 8A.
W82-00336

**ANALYSIS OF CAPACITY REQUIREMENTS FOR STORAGE RESERVOIRS: A CASE STUDY,**
Calgary Univ. (Alberta). Dept. of Civil Engineering.
I. Musik.
Canadian Journal of Civil Engineering, Vol 7, No 2, p 388-392, 1980. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Reservoir storage, *Storage requirements, *Stochastic process, Red Deer River, *Alberta, Streamflow, Drought, Case studies.

Three procedures for estimating reservoir storage from 61 years of historic mean monthly flows on the Red Deer River, Alberta, were considered. The stochastic simulation approach proved best because it allowed full extraction of information from the historic data on properties of inflow and generated 99 series of 100-year mean monthly flows for storage requirements analysis. The method of computing required storage capacity from the historic sample produced the minimum storage capacity, 225 million cu meters, but could not assign any probability of failure to satisfy the required yield. Using synthetic mass curves produced unrealistically high storage values because the curves did not indicate a realistic sequence of natural flows. (Cassar-FRC)
W82-00341

**AREAL PREDICTIONS OF WATER AND SOLUTE FLUX IN THE UNSATURATED ZONE,**
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
A. W. Warrick, and A. Amoozegar-Fard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-191124, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-058, June 1981. 4 p, 2 Fig, 1 Tab, 4 Ref.

Descriptors: *Soil water, *Surface water, *Flow discharge, *Salts, *Flow pattern, Soil physical properties, Simulation analysis, Drainage, Irrigation practices, Diffusion coefficient, Flow velocity, Unsaturated zone, Prediction.

This investigation was undertaken to develop procedures for evaluating distribution of water and salt fluxes over land areas. Relevant applications include numerical simulations and sampling in fields of large extent. The primary focus is on irrigated lands including effects of salinization and crops on the ground and surface waters. The study was in three parts: observations of distributions for a variety of soil physical parameters and inference on sampling; simulations of water and salt fluxes for nondeterministic systems; and a sensitivity analysis for drainage. Simulations of water and salt fluxes were made using the 'crude' Monte Carlo technique. For infiltration, 'Philip's' equation was utilized in a scaled form by solving one time. Individual simulations were made algebraically without repeating the laborious steps of resolving the unsaturated moisture flow equation each time. Similarly, results for the nonlinear drainage case were solved based on only one finite difference determination. The Monte Carlo simulation was carried out by simple interpo'ation from the one nonlinear solution. Unfortunately, no great shortcut was found for cyclic or seasonal irrigation regimes, although some interesting results based on linearized solutions were found for high frequency water applications. Salt distributions were calculated for cases of equal irrigation amounts over time but with intake rate varying over space. Deterministic calculations based on the mean velocity and apparent diffusion coefficient gave erroneous results compared to the 'average' values over the field for both salt profiles or fluxes. The true 'average' by depth for a given time is much more dispersed, with more salts reaching very deep depths and also with more salts remaining close to the surface when pulses of salt are added. Similarly, the mass emission of salts averaged over a field for a given depth appear earlier in time and taper off more gradually for a pulse input than deterministic calculations based on mean velocities would indicate. (Author's abstract)
W82-00381

**BEFORE THE WELL RUNS DRY: A HANDBOOK FOR DESIGNING A LOCAL WATER CONSERVATION PLAN.**
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 3D.
W82-00396

**DIGITAL MODEL OF THE UNCONSOLIDATED AQUIFER SYSTEM IN THE MODESTO AREA, STANISLAUS AND SAN JOAQUIN COUNTIES, CALIFORNIA,**
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W82-00415

## 6B. Evaluation Process

**ALTERNATIVES WORKING GROUP REPORT.**
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-800137, Price codes: A10 in paper copy, A01 in microfiche. In: Ground Water and Energy, Proceedings of the U.S. Dept. of Energy's National Workshop, Jan 29-31, 1980, Albuquerque, NM. Dept. of Energy Report CONF-800137, Nov 1980. p 167-183, 3 Fig, 1 Ref.

Descriptors: *Groundwater potential, *Groundwater availability, *Water supply development, *Legislation, Federal jurisdiction, State jurisdiction, Water rights, Environmental effects, Economic aspects, Social aspects, Water conservation, Impaired water use.

The working group discussed various technical and institutional alternatives for ground water use in energy development. As energy activities compete with other users for water supplies, ground water will become an attractive option. A matrix was developed to identify the attributes of ground water problems. Surface and ground water supplies are considered in relation to their physical availability; reliability; the impact of state laws, purchase rights and Federal laws on the water rights; environmental effects on water, air, and land; cost; and social acceptance. Using the matrix a small number of possible sources can be identified. Further consideration in light of cost and social acceptance should reveal the best water source. This analysis should take into consideration process changes such as dry cooling, recycling, and reuse; use of process-derived water; and technological substitution; all of which reduce the water demand or make use of low quality water. (Brambley-SRC)
W82-00032

**WATER QUALITY ISSUES AND ENERGY ASSESSMENTS,**
Argonne National Lab., Argonne, IL.
M. J. Davis, and S. Chiu.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/10154-01, Price codes: A04 in paper copy, A01 in microfiche. Dept. of Energy Report DOE/EV/10154-01, Nov, 1980. 64 p, 7 Tab, 67 Ref, 2 Append.

Descriptors: *Water quality, *Environmental effects, *Water pollution effects, *Fuel, Waste disposal, Resources development, Groundwater, Regional analysis, Energy sources.

A number of water quality issues will arise during assessments of the environmental impacts associated with various energy futures. Realistic assessment of the water quality impacts associated with future energy development requires that the most significant of these issues be properly addressed. The purpose of this report is twofold: first, to identify and to evaluate significant water quality issues related to regional and national assessments of energy developments; and second, to recommend for study related topics that bear on the capability to carry out such regional and national assessments. Issues concerning impacts on water quality include: impact of secondary effects of energy development; spills and accidental releases of pollutants; noncompliance with discharge requirements; solid waste disposal; coal mining; consumptive use and the maintenance of instream flow requirements; impacts on groundwater quality due to leaching, aquifer disruption, saltwater intrusion, waste disposal, and depletion; importance of hydroelectric load following for downstream conditions; inputs of pollutants to the Great lakes; atmospheric deposition and acid rain; salinity and energy-related residuals in the Colorado River Basin; biomass residue harvesting; synfuel development; and water quality impacts of energy developments in the coastal zone. Methodology issues in surface water quality assessments include: load estimation techniques; proper description of river basins; and water quality modeling procedures. (Moore-SRC)
W82-00036

**REPORT OF SURVEY OF CORPS OF ENGINEERS CONSTRUCTION WORKFORCE,**
Institute for Water Resources (Army), Fort Belvoir, VA.
C. M. Dunning.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A103324, Price codes: A07 in paper copy, A01 in microfiche. Research Report 81-R05, June 1981. 135 p, 3 Fig, 41 Tab, 31 Ref, 3 Append.

Descriptors: *Employment, *Social aspects, *Construction, *Economic impact, Benefits, Cost-benefit analysis, Dam construction, Unemployment, Reservoir construction, Flood control, *Engineering personnel, *Corps of Engineers.

A survey of the Corps of Engineers construction workforce was conducted in order to develop an

empirical basis for determining employment benefits due to construction of Corps projects, and to develop an empirical basis for determining the socioeconomic impacts of the workforce utilized for Corps project construction on local communities. The study is based on a 51-project sample selected from 136 projects constructed during 1979. The data base represents 4,089 complete responses from workers at a cross-section of Corps projects. Project types include: flood control, reservoirs, power projects, channels and harbors, locks and dam projects, beach erosion projects, and replacement projects. Some unemployment immediately prior to beginning work on Corps projects was reported by 39.6% of the workers. Clear differences in previous unemployment status were found among the workforce according to occupational group, locality, and the project area EDA status. The survey revealed that a large majority of the Corps' construction workforce is composed of local workers (69.4%). Approximately 60% of the non-local workforce is accompanied by dependents. A ratio of 1.24 dependents to each non-local worker was computed. For non-local workers, nearness to project site seems to be the most important housing choice location criterion. (Moore-SRC)
W82-00102

**REVIEW OF REPORTS FOR FLOOD CONTROL; WESTCHESTER COUNTY STREAMS, NEW YORK.**
Army Engineer District, New York.
For primary bibliographic entry see Field 4A.
W82-00103

**ENVIRONMENTAL IMPACT ASSESSMENT OF CHINA'S WATER TRANSFER PROJECT,**
Research Inst. on Environmental Science, Beijing (China).
For primary bibliographic entry see Field 6D.
W82-00129

**OPTIMAL DESIGN OF WATER CONVEYANCE SYSTEMS,**
Texas Dept. of Water Resources, Austin.
Q. W. Martin.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY9, p 1415-1433, September, 1980. 5 Fig, 2 Tab, 15 Ref.

Descriptors: *Water conveyance, *Design criteria, Conveyance structures, Water distribution, Aqueducts, Computers, *Cost analysis, Water supply systems, *Texas.

A procedure is described for establishing the minimum cost design and location of a water conveyance system. The design problem considered is limited to the evaluation of the construction of conveyance facilities to their ultimate flow capacity without consideration of capacity expansion. The application of the method is described for a potential water conveyance canal from Lake Texoma on the Texas-Oklahoma border to the upper Trinity River Basin watershed. The various corridors for a potential water conveyance facility from Lake Texoma to the Basin were evaluated using the largest scale US Geological Survey topographic map available. The use of the demographic and topographic information led to the immediate elimination of certain portions of the potential route. Some of the territory was occupied by cities or wildlife refuge locations, or was of high elevation. The remaining area was then examined using topographic maps based on a smaller scale. Using a composite map of four, 15 minute quadrant sheets, a set of 110 possible conveyance route sections and 90 junction points between the sections was delineated. The CANAL-I program is able to analyze up to 174 junctions and 250 route sections, with additional junction points and route sections being added to provide further detail. Several computer runs using CANAL-I were required. The use of this program significantly reduced the time required to determine reconnaissance level design for the water conveyance system. It is expected that in the future, use of this program will significantly cut costs in the construction and operation of water conveyance facilities. (Baker-FRC)
W82-00160

**WORTHLESS, VALUABLE, OR WHAT. AN APPRAISAL OF WETLANDS,**
Vermont Univ., Burlington.
J. Brande.
Journal of Soil and Water Conservation, Vol 35, No 1, p 12-16, January/February, 1980. 23 Ref.

Descriptors: *Wetlands, *Economic aspects, *Attitudes, Marshes, Swamps, Value, Drainage effects, Ecological effects, Hydrologic cycle, Hydrological regime, Reviews.

Wetlands have been recognized as having a positive value only in the past 30 years. This paper traces history of the negative attitude toward wetlands, swamps, and marshes from Hippocrates in the fourth century B.C., through Roman times, Shakespeare's writings, early American colonial leaders, and surveyors of the Dismal Swamp in Virginia to the recent literature. It is now realized that wetlands can improve water quality, store floodwaters, recharge groundwater supplies, provide habitat for wildlife and an environmental margin of safety, produce useful materials (peat, fish, game), protect shorelines from erosion, provide recreational and educational opportunities, purify the air, act as sound barriers, and provide a genetic reservoir. The vast amount of data on wetlands now being acquired must be translated and interpreted so that society can understand and use it, especially the economic aspects. If monetary values for the variety of wetland functions are assigned, the true value of these formerly 'dangerous' and 'worthless' areas may be realized. (Cassar-FRC)
W82-00177

**POWER PLANT WATER INTAKE ASSESSMENT,**
Consumers Power Co., Jackson, MI.
For primary bibliographic entry see Field 6G.
W82-00216

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: LEWIS RIVER BASIN, WASHINGTON.**
Federal Energy Regulatory Commission, San Francisco, CA. Office of Electric Power Regulation.
Report FERC-0067, January 1981. 59 p, 13 Fig, 6 Tab.

Descriptors: *Water resources development, *Hydroelectric plants, *Electric power production, *Flood control, Economic feasibility, Irrigation, Water supply, Navigation, Recreation, Water quality, Groundwater availability, Appraisals, *Lewis River basin, Washington.

The Lewis River basin has an area of 1,046 sq miles and there are four hydroelectric projects on the river. All but one are storage projects, which provide significant seasonal flow regulation of the river. The water resources of the basin have also been developed for irrigation, flood control, water supply, navigation, and water-based recreation. The license for the Merwin project has expired and it is being considered for relicensing. The plant is in good condition and the project appears to be economically favorable for continued operation. The major water resource management problems in the basin are related to water quality, groundwater availability, and municipal water supply, with flooding, preservation of instream flow values, and undeveloped water-related recreational potentials as lesser considerations. Seventeen conventional hydropower sites have been identified, but the economic feasibility of each project has not been determined. (Brambley-SRC)
W82-00370

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: ELWHA RIVER BASIN, WASHINGTON.**
Federal Energy Regulatory Commission, San Francisco. Office of Electric Power Regulation. Report FERC-0072, March 1981. 46 p, 11 Fig, 7 Tab, 6 Ref.

Descriptors: *Water resources development, *Hydroelectric plants, *Electric power production, *National parks, Water supply, Flood control, Recreation, Economic feasibility, Project planning, Fish management, Appraisals, *Elwha River basin, Washington.

The Elwha River basin has an area of about 321 sq miles, most of which is within national park or national forest boundaries. The water resources of the basin have been developed to provide for water supply, flood control, recreation, and hydropower. There are two hydroelectric plants on the river, and, given the restrictions on development within national parks, it is unlikely that further development will be allowed. The Glines Canyon Dam is within Olympic National Park, and functions essentially as a run-of-river powerplant. It is well maintained and seems to be an economical source of power and recreational activities for many years. Five potential conventional and hydroelectric and one potential pumped storage site have been considered, but will not now be developed. At both projects regulation for minor flood control should be undertaken. It is recommended that a fish passage facility be constructed at the Elwha Dam, and that Lake Aldwell be regulated in the future to provide water supply and streamflow regulation for fish. (Brambley-SRC)
W82-00371

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: LITTLE TENNESSEE RIVER BASIN, TENNESSEE, NORTH CAROLINA, AND GEORGIA.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation. Available from Supt. of Documents, GPO, Washington, DC 20402. Report FERC-0066, January 1981. 83 p, 17 Fig, 19 Tab.

Descriptors: *Water resources development, *Hydroelectric plants, *Electric power production, *Economic feasibility, Project planning, Water level fluctuations, Minimum flow, Environmental effects, Fish management, *Little Tennessee River basin, Tennessee, North Carolina, Georgia.

The Little Tennessee River basin has an area of 2,627 sq miles; the river is 602 miles long, and there are 17 licensed hydroelectric developments in the basin. Six other projects have license applications pending. Together they have an installed capacity of 93,975 kilowatts. All the projects are in good physical condition and appear to be capable of providing an economic source of power for the foreseeable future, and it may be economic to expand them. Minimum flow regulations and reservoir water level fluctuations for the benefit of fish are considerations in the possible licensing of these projects. The projects are economically justified, and are not environmentally harmful. There is potential for further hydroelectric development in the basin, up to 4,000 megawatts, 98% of which would be from pumped storage. (Brambley-SRC)
W82-00372

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: PIT RIVER BASIN, CALIFORNIA.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation. Available from Supt. of Documents, GPO, Washington, DC 20402. Report FERC-0045-2, September 1980, 85 p, 39 Fig, 22 Tab, 8 Ref, Append.

Descriptors: *Water resources development, *Hydroelectric plants, *Electric power production, *Economic feasibility, *Flood control, Environmental effects, Fish management, Dam construction, Irrigation, Recreation, Land use, Appraisals, *Pit River basin, California.

The Pit River basin has an area of 6,100 sq miles, and there are nine hydroelectric developments on the Pit River with a generating capacity of 725,150 kilowatts. The license for Project 233, comprising three developments, has expired, and the project is

being considered for a new license. The plants are in good operating condition and can continue to be an economic source of power. Continuation of the existing reservoirs would not have significant adverse effects on the environmental aspects of the basin, but some alterations in operation may be necessary to improve fish management. Flood control is needed in the basin to alleviate flooding downstream on the Sacramento River. Since it would not be economic to use or modify the existing hydroelectric projects for this purpose, new projects have been suggested. The Allen Camp project would provide benefits from irrigation, recreation, flood control, power, fish and wildlife enhancement, and area development, and would possibly provide headwater improvement to hydroelectric power at the downstream plants, but since the original study this project has become unfavorable economically. One of the three potential hydroelectric projects is considered economically favorable. (Brambley-SRC)
W82-00373

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: CLARK FORK-PEND OREILLE RIVER BASIN, MONTANA, IDAHO, WASHINGTON.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
Available from Supt. of Documents, GPO, Washington, DC 20402. Report FERC-0062, September 1980. 108 p, 37 Fig, 32 Tab, 8 Ref.

Descriptors: *Water resources development, *Hydroelectric plants, *Electric power production, *Economic feasibility, Project planning, Water conservation, Irrigation, Municipal water, Flood control, Water quality control, Recreation, Wildlife management, Colorado River basin, *Clark Fork-Pend Oreille River basin.

The Clark Fork-Pend Oreille River basin is a major component of the Columbia River basin, having a drainage area of 25,800 sq miles, of which 1,203 sq miles are in Canada. There are 13 hydroelectric generating plants in the United States portion. The license for the Thompson Falls plant expired in December 1975 and was renewed in December 1979, and the license for the Kerr plant expired in May 1980 and is currently operating under an annual license. This plant is in good physical condition and is capable of providing an economical source of power for an extended period. Preliminary studies indicate that an additional generating unit would be economic. Thirteen potential conventional power projects and five additions to existing hydroelectric projects are discussed. The principal purposes of these developments would be to provide hydroelectric power, water conservation for irrigation and municipal supply, and flood control, with consideration being given to fish and wildlife management, water quality control, and water-oriented recreation. A preliminary economic analysis of the new projects indicates that five projects have favorable energy economics, while four of the five additions are economically favorable. (Brambley-SRC)
W82-00374

**ASSESSMENT OF SOLVENT EXTRACTION FOR TREATMENT OF COAL GASIFIER WASTEWATER,**
Missouri Univ.-Columbia.
For primary bibliographic entry see Field 5D.
W82-00439

**SUMMARY OF THE NEW ENGLAND CONFERENCE ON LEGAL AND INSTITUTIONAL INCENTIVES TO SMALL-SCALE HYDROELECTRIC DEVELOPMENT, JANUARY 30-31, 1979, BOSTON, MASSACHUSETTS.**
Franklin Pierce Law Center, Concord, NH. Energy Law Inst.
For primary bibliographic entry see Field 6E.
W82-00447

## 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

**WESTERN WATER RESOURCES: COMING PROBLEMS AND POLICY ALTERNATIVES,**
Federal Reserve Bank of Kansas City, MO.
For primary bibliographic entry see Field 6D.
W82-00107

**THE VALUATION OF RECREATIONAL FISHERIES,**
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. Cauvin.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 8, p 1321-1327, August, 1980. 17 Ref.

Descriptors: *Recreation demand, *Fisheries, *Resources allocation, Value, Pricing, Economic aspects, Resources allocation, *Canada.

The present concept of recreational fisheries in Canada as a nonpriced resource should be changed. These techniques do not allow a realistic value to be assigned for allocation and management decision making. Two valuation techniques, favorable in Western Canada, are discussed--the willingness to pay method and the expenditure method. When the government provides free or nominal-cost fishing, overallocation of resources for fisheries or distorted demand statistics result. The argument is made that recreational fishing should be priced in spite of the difficulties and of the opposition posed by fishermen and by governmental agencies charged with administration of this work. (Cassar-FRC)
W82-00348

## 6D. Water Demand

**GROUND WATER AVAILABILITY,**
Geological Survey, Denver, CO. Water Resources Div.
H. H. Hudson.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-800137. Price codes: A10 in paper copy, A01 in microfiche. In: Ground Water and Energy, Proceedings of the U. S. Department of Energy's National Workshop, January 29-31, 1980, Albuquerque, New Mexico. Department of Energy Report CONF-800137, November 1980. p 37-47, 13 Ref.

Descriptors: *Groundwater availability, Groundwater potential, *Resources development, *Water supply, Surface water availability, *Water demand, Oil shale, Coal, Energy sources, Regional development.

When water requirements for energy resource development are considered, it is generally only surface water that is considered. In both the Upper Missouri and Upper Colorado River basins there are extensive coal and oil shale reserves, but the surface water reserves which are not already allocated are inadequate. In studies in which scenarios were developed, water sources were generally not indicated. The more recent studies indicate that less water would be needed than the earlier studies indicated. While surface water resources are well known, ground water resources tend to be estimates, with quantity and quality unknown. It is suggested that this ground water resource may provide the water necessary for energy development, once the supply is sufficiently studied. Water of low quality, which is unsuitable for domestic or agricultural purposes, may be suitable for energy development processes, particularly in coal-slurry pipelines. Use of ground water may overcome some of the legal, economic, political, institutional and environmental conflicts which accompany the use of surface water. (Brambley-SRC)
W82-00027

**GROUND WATER ALTERNATIVES AND SOLUTIONS,**
Los Alamos Scientific Lab., NM.
F. Roach.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-800137, Price codes: A10 in paper copy, A01 in microfiche. In: Ground Water and Energy, Proceedings of the U.S. Department of Energy's National Workshop, January 29-31, 1980, Albuquerque, New Mexico. Department of Energy Report CONF-800137, November 1980. p 65-94, 13 Fig.

Descriptors: *Water supply, *Water demand, *Economics, *Groundwater potential, Groundwater availability, Groundwater depletion, Resources development, Aquifers, Saline water, Surface water availability, Energy sources, *Impaired water use.

It is generally acknowledged that surface water supplies will not be able to meet the demands of a developed energy industry in many areas of the U.S. Increasing claims on this resource may put the price out of an economic range for energy or other users. Using maps of energy resources, surface water, ground water use, and saline and deep aquifers, it can be shown that while the energy resources generally occur in areas with surface water problems, they occur outside areas with high ground water use. They coincide well with areas of saline and deep aquifers. Saline and low quality water has applications in the energy industry such as: in cooling water systems; air pollution control systems; waste disposal; conversion process modifications; mining; and coal slurry pipelines. Use of saline water has the economic advantages of lower development costs, adding little to the product price, and lessening the political and transaction costs. The use of ground water, and ground water in conjuction with surface water, is a solution to the water needs of the energy industry, and there are opportunities for the industry to cooperate with other users in developing water sources for all. (Brambley-SRC)
W82-00029

**SUPPLY WORKING GROUP REPORT.**
Available from the National Technical Information Service, Springfield, VA as CONF-800137, Price codes: A10 in paper copy, A01 in microfiche. In: Ground Water and Energy, Proceedings of the U.S. Department of Energy's National Workshop, January 29-31, 1980, Albuquerque, New Mexico. Department of Energy Report CONF-800137, November 1980. p 131-144, 2 Ref.

Descriptors: Groundwater availability, *Groundwater potential, *Geohydrology, *Hydrologic cycle, Water supply, *Water demand, Surface water, Energy sources.

The primary objective of the Supply Working Group was to discuss the Office of Technology Impacts' (OTI) procedures for assessing the potential impacts of using ground water for energy production. Four levels or categories of OTI assessments were thought to be necessary: national, State/regional, basin, and site-specific. The needs of the national assessment could be met by collecting and summarizing information on ground water across the nation, but the other three levels of assessment would require more than an aggregation of available information. Ground water is part of the hydrologic cycle and cannot be considered separately from surface water when water supplies are being assessed. At the basin or aquifer level, an interpretation of the hydrologic unit requires the following information: geologic configuration, aquifer and basin boundaries, recharge and discharge, capture potential, storage capabilities, transmissive qualities, quality characteristics, transport or dispersive qualities, water dating, and water demand. Development of ground water is possible only when it is hydrologically and economically feasible and will always be accompanied by declining water levels and stream flow depletion. The group identified data base issues, fundamental issues, saline aquifer issues, impacts of ground water development, permit and legislation issues, modeling, relocation and reallocation, and general issues. (Brambley-SRC)
W82-00030

**CONFLICTS AND BARRIERS WORKING GROUP REPORT.**
For primary bibliographic entry see Field 6E.
W82-00031

**WATER-RELATED ENVIRONMENTAL CONTROL REQUIREMENTS AT MUNICIPAL SOLID WASTE-TO-ENERGY CONVERSION FACILITIES,**
Iowa State Univ., Ames.
For primary bibliographic entry see Field 5D.
W82-00037

**WATER RELATED PLANNING AND DESIGN AT ENERGY FIRMS,**
Los Alamos Scientific Lab., NM.
D. Abbey, and F. Lucero.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/10180-1, Price codes: A03 in paper copy, A01 in microfiche. Department of Energy Report DOE/EV/10180-1, November 1980. 44 p, 8 Fig, 6 Tab, 23 Ref.

Descriptors: *Water demand, *Water allocation, *Planning, *Powerplants, Cost analysis, Water use, Cooling water, Water scarcity, Wastewater treatment, Waste disposal, Water treatment, Water reuse, Energy sources.

Energy production and conversion activities have historically been water intensive, so accelerated domestic energy production is expected to make increased demands on water resources. By identifying production alternatives and specifying their costs under a variety of conditions, future patterns of water use in the energy industry and its response to water-related regulation may be projected. The three principal decisions of industry that affect water allocation are where to build plants, where to get water, and how much water to use. Site selection is currently based on water supplies for evaporative cooling; this may change in response to increasing water scarcity. Water may be acquired from a number of sources; the source will be selected on the basis of uncertainty, risk, transaction and engineering costs. Water system design entails the evaluation of tradeoffs among water intake, water treatment, and wastewater disposal costs. A survey of recently constructed and planned plants shows that water supply costs are site-specific, and the following conclusions may be drawn. If water intake or disposal costs are nonzero, recirculating systems are cheaper than once-through systems. Treatment costs for low quality water may be less than transport costs for high quality water. Discharge standards and disposal costs promote the maximum degree of recirculation, reuse, and treatment. Dry cooling has great potential for application at synthetic fuel plants and very limited potential at electric plants. (Brambley-SRC)
W82-00042

**WATER SUPPLY AND DEMAND IN AN ENERGY SUPPLY MODEL,**
Los Alamos Scientific Lab., NM.
D. Abbey, and V. Loose.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/EV/10180-2, Price codes: A04 in paper copy, A01 in microfiche. Department of Energy Report DOE/EV/10180-2, December 1980. 63 p, 1 Fig, 17 Tab, 79 Ref.

Descriptors: *Resource development, *Water supply, *Water demand, Water conservation, *Industrial water, *Model studies, Cooling water, Groundwater, Water scarcity, Irrigation water, Energy sources.

Environmental factors are frequently omitted from energy supply models. This report describes a tool for water and energy related policy analysis, the development of a water supply and demand sector in a linear programming model of energy supply in the United States. The model allows adjustments in the input mix and plant siting in response to water scarcity. On the demand side, energy conversion facilities can substitute more costly dry cooling systems for conventional evaporative systems. On the supply side, groundwater and water purchased from irrigators are available as more costly alternatives to unappropriated surface water. The availability of water was determined from water basin information for 30 regions in 10 Western states. Preliminary results for a 1990 energy demand scenario suggest that, at this level of spatial analysis, water availability plays a minor role in plant siting. Certainly, there are legal and institutional impediments to the procurement of large industrial water supplies. But, as represented by the structure and data inputs of the model, there are a variety of water use alternatives available to energy firms when any one option is foreclosed. (Moore-SRC)
W82-00050

**A 10-YEAR PLAN TO STUDY THE AQUIFER SYSTEM OF INDIAN WELLS VALLEY, CALIFORNIA,**
Geological Survey, Menlo Park, CA. Water Resources Div.
P. Lipinski, and D. D. Knochenmus.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $5.75 in paper copy, $5.00 in microfiche. Geological Survey Open-File Report 81-404, June 1981. 16 p, 4 Fig, 12 Ref.

Descriptors: *Planning, *Aquifer systems, *Groundwater, *Water resources development, Pumpage, Over-draft, Groundwater recharge, Observation wells, Water level, Water quality, Model studies, Prediction, Evaluation, Water management, *California, Indian Wells Valley, China Lake.

Water needs of the population of Indian Wells Valley, Calif., must be met through further development of ground-water resources. Studies show that annual ground-water pumpage there has increased since 1945 and has exceeded mean annual recharge since 1966. Continued and increased stress on the aquifer system of the valley is expected because population in the valley is predicted to double by 1998 and triple by 2020, based on 1977 population figures. The U.S. Geological Survey proposes a 10-year program to develop a data base to aid in evaluation of future water-management alternatives. A study plan has been developed that describes present and potential problems and objectives of the program, and outlines work items to be undertaken in the study area. (USGS)
W82-00086

**WESTERN WATER RESOURCES: COMING PROBLEMS AND POLICY ALTERNATIVES,**
Federal Reserve Bank of Kansas City, MO.
M. Duncan, and A. Laing.
Journal of Soil and Water Conservation, Vol 35, No 3, p 192-195, July/August, 1980. 2 Fig.

Descriptors: *Water policy, *Water law, *Water allocation, *Water management, Water resources development, Water demand, Water supply, Water shortage, Water conservation, Western states, Legislation, Decision making, Financing, Legal aspects, Political aspects, Economic aspects.

Water resources in the western United States are becoming increasingly scarce and expensive. A symposium in Denver, Colorado, examined the coming problems and some policies for coping with them. The two fundamental difficulties in formulating a natural resource policy are finding the right balance between private and public resource development, and the harmonization between individual and group decision making. An area of great potential conflict may be Indian water claims; no definitive judicial decisions have been handed down to supplement the 1908 Winters Doctrine. Methods of meeting water shortages can include interbasin transfers, additional impoundments, better knowledge of aquifer recharge systems, and forecasting and management of precipitation as well as the more exotic proposals--snowfield management, iceberg towing, and undersea aqueducts. The most practical means of saving water was judged to be demand reduction by full-cost pricing and more reuse and recycling. The water allocation process must be improved to reflect the actual conditions in the west and must not be used to manipulate land use and economic development. Benefit-cost analysis should be used in the decision making process, although this method is not without difficulties. (Cassar-FRC)
W82-00107

**ENVIRONMENTAL IMPACT ASSESSMENT OF CHINA'S WATER TRANSFER PROJECT,**
Research Inst. on Environmental Science, Beijing (China).
C. Yiqiu.
Water Supply and Management, Vol 5, No 3, p 253-260, 1981. 1 Fig, 2 Tab.

Descriptors: *Water supply development, *Decision making, *Water transfer, Planning, Water resources development, *Water transport, Water demand, Water shortage, Pipelines, Water delivery, *China.

China's South-to-North Water project is a broad concept employing numerous pipelines for diverting water of the Yangtze river in the south to the north of the Yellow River. In 1975 the North China Plain suffered an acute water shortage, and the Eastern Line was proposed by the relevant agencies in 1976 as the first phase of the plan to be established. Since the water supply is interrelated with the regional economy and agricultural production, these factors should be considered conjunctively. An environmental impact assessment must be performed as well; it has two major purposes. The first is to assess the impacts of the proposed projects on the environment, and the second is to select alternatives which might achieve the same goal as the proposed project, while minimizing any harmful effects. The material and technical data presently available for such assessments is quite limited. Thus the alternative to the Eastern Line, the Middle Eastern Line, is being left in its preliminary form. However, the general trend is clear: by taking the Middle Eastern Line as the first phase projct for diverting water of the Yangtze River to the north of the Yellow River, both capital cost and annual operating cost can be economized, as compared with the Eastern Line alone. The cost/benefit ratio will be much lower than that of the Middle Line alone. Most of the environmental problems inherent in the Eastern Line can be avoided. The Middle Eastern Line will be able to accommodate changes in the future. (Baker-FRC)
W82-00129

**SMALL-SCALE HYDRO IN NEW ENGLAND: 1960-1976,**
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
P. H. Kirshen.
Journal of the Energy Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EY1, p 31-39, May, 1981. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Hydroelectric power, *Time series analysis, *Reviews, Hydroelectric plants, Electric power production, Water resources development, *New England, Dams, Dam effects, Powerplants, Electric powerplants.

A review of the small-scale hydropower (SSH) plants in New England from 1960-1976 is presented by a time series analysis as part of a project to study the obstacles and incentives to the development of such facilities. Since 1960, the installed conventional hydroelectric capacity of the United States has increased steadily, while the total number of plants has decreased. SSH in New England has steadily decreased from 828 megawatts in 1960 to 750 megawatts in 1976. However, the average plant size in New England in 1976 was decreased over average sizes for 1960. Large-scale hydroelectric power (LSH) in New England is used primarily for peak production, while SSH is used for smaller projects. As the price of fossil fuels continues to increase, so does the demand for hydroelectric power. Industrial use of SSH has declined, while the interest of municipalities and rural electric cooperatives in SSH has expanded. A potential 1,000 megawatts of unharnessed SSH exists at nongenerating dams in New England. To

expedite licensing processes to take advantage of these sites, several federal and private institutions are studying developmental strategies to be considered by environmental policymakers. (Geiger-FRC)
W82-00169

**DOMESTIC WATER SUPPLIES FOR POWER PLANT COOLING,**
Technion-Israel Inst. of Tech., Haifa.
G. Sinai, W. A. Jury, and L. H. Stolzy.
Journal of the Energy Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EY1, p 149-165, May, 1981. 7 Fig, 4 Tab, 23 Ref.

Descriptors: *Environmental effects, *Cooling water, *Thermal pollution, Water cooling, *Powerplants, Electric powerplants, Waste heat, Heated water, Thermal capacity, Water pollution effects, Conveyance structures, Aqueducts.

The once-through conveyor (OTC) method for powerplant cooling which utilizes water from large domestic networks close to the site of the powerplant is described. The OTC system siphons water from the domestic system and passes it once through the power plant condenser and returns the slightly warmed water to a point downstream from the intake area. The OTC system is proposed as a feasible source of cooling water which could meet the anticipated expasion rates of electrical power plants in the western United States. No adverse environmental effects are expected from this inland cooling system, and the OTC method is very inexpensive to construct and operate. Estimations of thermal capacity of major water supply systems in the Southwest show that such states as Arizona and California are already in excess of the anticipated demand for additional electricity generation in the near future. It was suggested that new powerplants be located along large aqueducts of these states to utilize their thermal cooling capacity in OTC systems. (Geiger-FRC)
W82-00180

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: SKAGIT RIVER BASIN, WASHINGTON.**
Federal Energy Regulatory Commission, San Francisco, CA. Office of Electric Power Regulation.
Available from Supt. of Documents, GPO, Washington, DC 20402. Report FERC-0057, August 1980. 83 p, 22 Fig, 14 Tab, 5 Ref.

Descriptors: *Water resources development, *Hydroelectric plants, *Electric power production, *Economic feasibility, *Flood control, Project planning, Flood damage, Dam construction, Water supply, Water demand, *Skagit River basin, Washington.

The Skagit River is about 163 miles long, and the basin has an area of 3,105 sq miles, of which 381 sq miles are in Canada. There are six hydroelectric generating projects on the river, with an average annual generation of 3,061 gigawatt-hours. The Ross Reservoir and Upper Baker project are used for flood control, regulating 41% of the drainage basin. Significant flood damage continues to occur annually. An addition of 121 ft to the height of the Ross Dam has been authorized. Surface water supplies are capable of exceeding municipal and industrial needs through the year 2020, and surface and groundwater sources are capable of meeting anticipated demands for irrigation water. All the projects are in good physical condition. Their continued use is economically useful, and some expansion seems feasible, if reregulation of flows from the dams is provided, and if a demand for capacity develops. (Brambley-SRC)
W82-00368

## 6E. Water Law and Institutions

**REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS--OKLAHOMA, 1980 WATER YEAR,**
Geological Survey, Little Rock, AR. Water Resources Div.
G. L. Ducret, Jr.
Geological Survey Open-File Report 81-208, 1981. 25 p, 1 Fig, 3 Tab, 3 Ref.

Descriptors: *Interstate compacts, *Interstate rivers, *Arkansas, *Oklahoma, *Streamflow, Flow rates, Gaging stations, Water yield, Runoff, Reservoir storage, *Arkansas River basin.

The computed annual yield and deficiency of the subbasins as defined in the Arkansas River Compact, Arkansas-Oklahoma, are given in tables. Actual runoff from the subbasins and depletion caused by major reservoirs in the compact area are also given in tabular form. Monthly, maximum, minimum, and mean discharge is shown for the 15 streamflow stations used in computing annual yield. (USGS)
W82-00012

**GROUND WATER CONFLICTS AND BARRIERS,**
Arizona Univ., Tucson. Law School.
R. E. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-800137, Price codes: A10 in paper copy, A01 in microfiche. In: Ground Water and Energy, Proceedings of the U.S. Department of Energy's National Workshop, January 29-31, 1980, Albuquerque, New Mexico. Department of Energy Report CONF-800137, November 1980. p 49-63, 43 Ref.

Descriptors: *Groundwater potential, *Water law, *Legislation, Groundwater management, State jurisdiction, Federal jurisdiction, Public rights, Water rights.

Three main areas of tension involving old ground water claims, emerging rights, and statutory provisions for transfers to different uses and places of use are outlined, with primary emphasis on the western U.S. The three areas are state law, U.S. claims and reserved rights, and intrastate and interstate opportunities. Water law is mainly property law and almost entirely state law, with ground water law being even more local than surface water law, and being developed much later. Weaknesses in ground water law include conflict over public versus private rights, water uses, quality, and water management. It is very difficult to enact legislation that will integrate surface and ground water management and encourage conservation, easy transfers, local management, and better water quality. The Federal Government, as owner of public lands, appropriates the water rights of these lands. These lands are under pressure for their water resources. Two complementary approaches to improving ground water law are suggested: legislation can be prepared that will confront and minimize many old conflicts, settle claims and determine rights; and procedures can be proposed for anticipating conflicts which have not reached the courts, including interstate conflicts. (Brambley-SRC)
W82-00028

**CONFLICTS AND BARRIERS WORKING GROUP REPORT.**
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-800137, Price codes: A10 in paper copy, A01 in microfiche. In: Ground Water and Energy, Proceedings of the U.S. Dept. of Energy's National Workshop, Jauary 29-31, 1980, Albuquerque, New Mexico. Dept. of Energy Rept. CONF-800137, November, 1980. p 145-165.

Descriptors: *Environmental effects, *Groundwater potential, Groundwater availability, Energy sources, *Economic aspects, *Legal aspects, Political aspects, Jurisdiction, Legislation, Public opinion, Social impact, Water supply, Water demand, Water pollution, Land use, Water rights.

This group focused on identifying the nature, prevalence, and importance of conflicts that might arise, and the barriers likely to be encountered in using ground water for energy production purposes. Conflicts were categorized as institutional/political, Indian, physical, environmental, economic, and legal. The institutional/political issues arise because of competing jurisdiction over water issues, inadequate or non-existent laws, dispersion of urisdiction amony Federal and state agencies, and local public objection to development. Indian issues include problems of ownership rights, social impacts of development, division of opinion within the Indian population, and resistance to development of resources for the benefit of non-Indians. Physical issues produce conflicts over interference with shallow wells and streamflow, excessive withdrawals, demand versus supply, subsidence and salt water intrusion, and the poor quality of aquifers and their poential pollution. The environmental issues identified relate to the physical problems in terms of flow disruption, pollution, and changes in land use, and a general lack of data. Economic conflicts arise due to values assigned to water uses, costs of pollution, delays in projects, and third-party effects. Legal conflicts arise when there are competing demands on water supplies, competing values, uncertainties over water rights, and deficiencies in reallocation mechanisms, and when water quality and quantity are considered separately, and the interstate nature of many aquifers is not considered. (Brambley-SRF)
W82-00031

**ALTERNATIVES WORKING GROUP REPORT.**
For primary bibliographic entry see Field 6B.
W82-00032

**LEGAL ASPECTS OF SUBSIDENCE DUE TO WELL PUMPING,**
California Dept. of Water Resources, Sacramento.
W. Kopper, and D. Finlayson.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 107, No IR2, p 137-149, June, 1981. 55 Ref.

Descriptors: *Subsidence, *Pumpage, *Legal aspects, *Judicial decisions, *Statutes, Wells, Institutional constraints, Law enforcement, Compaction, Flooding, Withdrawal, Drawdown, Groundwater storage, Available water, Aquifers, Economic aspects, Land subsidence.

The legal roots of the United States' 'laissez faire' attitude toward groundwater pumpage and subsidence are discussed. Some of the legal precedents which indicate a shift in policy toward holding pumpers liable for subsidence are identified, and innovative programs for the management of groundwater are reviewed. Most early cases endorsed the English common law rule and the principle of 'damnum absque injuria', or no remedy under the law for injury. A restatement of Torts II in 1969 provided a foundation for interpreting liability to include subsidence. The largest damage suit for subsidence related to pumpage was the United States Versus Anchor Oil. It provided numerous technical reports and briefs which are useful. However, the case did not go to trial. A landmark decision in Texas, Coastal Industrial Water Authority Versus W. B. York, held that a property owner did not lose title to property that became submerged. Subsequent cases in Texas contained language indicating that the court would recognize and apply the law of negligence along with willful waste and malicious injury as limitation on the existing rulings. Model legislation based upon local control of groundwater has been developed in California to address a need for basin management. The proposed legislation gives the management authority broad powers to implement various activities. (Titus-FRC)
W82-00170

**POLLUTANT TREATABILITY: A MOLECULAR ENGINEERING APPROACH,**
Environmental Protection Agency, Washington, DC.
M. P. Strier.
Environmental Science and Technology, Vol 14, No 1, p 28-31, January, 1980. 6 Tab.

Descriptors: *Water pollution control, *Molecular structure, Chemical properties, Physical proper-

ties, Organic compounds, Filtration, Oxidation, Biodegradation, Activated carbon, Carbon, Adsorption, *Wastewater treatment, Effluents.

At present, in order to comply with restrictions laid down by the Clean Water Act Amendments of 1977, the idea prevails of developing a separate treatment model for each nonpesticidal toxic organic compound, based on fundamental physical and chemical data. Based on experience with evaluating treatment processes, the following five unit treatment processes were used in this investigation: steam- or air-stripping, oil/water separation, filtration on diatomaceous earth or dual media, biochemical oxidation, and activated-carbon adsorption. These suggested potential treatment processes were separately applied to treatment models for each pollutant considered. Steam stripping possibilities are determined by the boiling point of the organic contaminant. Oil-water separation is a good procedure for compounds having relatively low solubilities in water. Separation is achieved by means of API separation or dissolved air flotation. Filtration is used for compounds having low water solubilities and tending to be highly adsorptive on particulate matter, organic or inorganic. Biochemical oxidation can reduce an influent concentration of about 100 mg/liter for phenols to an effluent concentration of 50 micrograms/liter, maximum. Carbon adsorption is particularly effective for compounds of higher molecular weight, lower polarity, increasing hydrocarbon unsaturation, and aromatic structure. Pollutant solubility in water may be associated with entropy, which opposes the driving force for removing the substance from water. This is particularly evident when phenolic and nitrogen-containing compounds are considered. (Baker-FRC)
W82-00252

**GRAPHICAL EFFLUENT QUALITY CONTROL FOR COMPLIANCE MONITORING: WHAT IS A VIOLATION,**
Illinois Environmental Protection Agency, Springfield.
For primary bibliographic entry see Field 5G.
W82-00261

**A 201 POLLUTION CONTROL PLANNING TRAGEDY,**
R. E. Wallace.
Public Works, Vol 111, No 1, p 54-60, January, 1980. 2 Fig.

Descriptors: *Political aspects, *Governmental interrelations, *Financing, Wastewater treatment facilities, *Northwest Hillsborough County, *Florida, Water pollution control, Water policy, Planning, Grants, Federal Water Pollution Control Act, Economic aspects, Government supports.

The sequence of events in the Section 201 (Federal Water Pollution Control Act) funding of the Northwest Hillsborough County, Florida, wastewater treatment facilities is detailed, starting in 1970 when the Board of County Commissioners decided to acquire private franchises and move toward a regional wastewater treatment system. The original 1973 plans called for $22 million in capital expenditures and engineering fees. As a result of delays and intergovernmental confusion, actual costs escalated to $49 million. Construction finally started in March 1979, with completion scheduled for March 1980. The author places the blame for the County's problems on overworked grant administrators, poorly written regulations and guidelines, constantly changing decisions, involvement of too many agencies and political bodies, lack of attention to nonpoint sources, too much reliance on computer models, and lack of agreement on what constitutes pollution. (Cassar-FRC)
W82-00285

**WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING: LITTLE TENNESSEE RIVER BASIN, TENNESSEE, NORTH CAROLINA, AND GEORGIA.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
For primary bibliographic entry see Field 6B.
W82-00372

**THE U.S. GEOLOGICAL SURVEY COAL HYDROLOGY PROGRAM AND THE POTENTIAL OF HYDROLOGIC MODELS FOR IMPACT ASSESSMENTS,**
Geological Survey, NSTL Station, MS. Water Resources Div.
W. H. Doyle, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-542, 1981. 56 p, 4 Fig, 5 Tab, 29 Ref.

Descriptors: *Coal, *Hydrologic models, *Strip mines, *Surface water, Mathematical models, Simulation, Coal mining, Soil erosion, Evaluation, Small watersheds, *Tennessee, *Indiana, Public Law 95-87, Geological Survey Coal Hydrology Program.

A requirement of Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977, is the understanding of the hydrology in actual and proposed surface-mined areas. Surface-water data for small specific-sites and for larger areas such as adjacent and general areas are needed also to satisfy the hydrologic requirements of the Act. The Act specifies that surface-water modeling techniques may be used to generate the data and information. The purpose of this report is to describe how this can be achieved for smaller watersheds. This report also characterizes 12 'state-of-the-art' strip-mining assessment models that are to be tested with data from two data-intensive studies involving small watersheds in Tennessee and Indiana. Watershed models are best applied to small watersheds with specific-site data. Extending the use of modeling techniques to larger watersheds remains relatively untested, and to date the upper limits for application have not been established. The U.S. Geological Survey is currently collecting regional hydrologic data in the major coal provinces of the United States and this data will be used to help satisfy the 'general-area' data requirements of the Act. This program is reviewed and described in this report. (USGS)
W82-00429

**SUMMARY OF THE NEW ENGLAND CONFERENCE ON LEGAL AND INSTITUTIONAL INCENTIVES TO SMALL-SCALE HYDROELECTRIC DEVELOPMENT, JANUARY 30-31, 1979, BOSTON, MASSACHUSETTS.**
Franklin Pierce Law Center, Concord, NH. Energy Law Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/RA/04934-03, Price codes: A04 in paper copy, A01 in microfiche. Department of Energy Report DOE/RA/04934-03, May 1980. 74 p, 47 Ref, 5 Append.

Descriptors: *Hydroelectric power, *Institutional constraints, *Federal jurisdiction, *State jurisdiction, *Regulations, Water use, Economic aspects, Model studies, Policy making, Financing, Subsidies, *New England.

Workshops were held addressing the topics: Federal regulatory systems; state regulatory systems; the economics of small-scale hydroelectric development; and systems dynamics and the systems dynamics model. Problems discussed at the Federal workshops included definitions with the Public Utilities Regulatory Policies Act (PURPA), streamlining the regulatory systems, and conflicts over competing uses of water. The states workshops discussed these topics and concern for markets, the problems of incentives for hydro development, and local processes. The economics workshops discussed the importance of determining a supply curve for small-scale hydro, and the establishment of an energy futures market in small-scale hydro. The systems workshop demonstrated how the model HYDRO I can be used in policy analysis and to predict the amount of small-scale hydro in New England over the next 20 yrs. It was suggested that the Federal Energy Regulatory Commission be able to approve a state hydro licensing plan, and then defer licensing of small-scale hydro projects to the state. Credits and allowances should be permitted for the financing of fish passage ways. State licensing reform may take the form of lead agency licensing, the removal of small-scale hydro from state utility regulations and tax laws, and provision of direct subsidies and other incentives. (Brambley-SRC)
W82-00447

**EXECUTIVE SUMMARY, LEGAL OBSTACLES AND INCENTIVES TO SMALL-SCALE HYDROELECTRIC DEVELOPMENT IN THE SIX MIDDLE ATLANTIC STATES.**
Franklin Pierce Law Center, Concord, NY. Energy Law Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/RA/04934-06, Price codes: A04 in paper copy, A01 in microfiche. Department of Energy Report DOE/RA/04934-06, May 1980. 68 p, 6 Fig.

Descriptors: *Hydroelectric power, *Legal aspects, *Legislation, *State jurisdiction, *Regulations, *Economic aspects, Dams, Water rights, Taxes, Competing use, Economic development, Delaware, Maryland, New Jersey, New York, Pennsylvania, Virginia.

Executive summaries of the regulation of small dams are presented for Delaware, Maryland, New Jersey, New York, Pennsylvania, and Virginia. The water laws of each state are reviewed briefly as they pertain to riparian rights, navigable waters, natural flow doctrine, reasonable use, and the presence or absence of a Mill Dam Act. Direct regulation of small-scale hydroelectric projects is the responsibility of a number of state agencies and commissions, and of municipalities through zoning regulations. The projects may be affected by indirect regulations such as energy policy, protection of historic sites, wild and senic river designation, water quantity or quality requirements, wetlands protection, soil and water conservation, recreational facilities and fish and game projects, and endangered species protection. Finanical considerations include both taxation and rate setting powers vested in the states and their agencies, and the provision of various forms of financial assistance to promote economic growth and employment. A flow diagram for regulation is given for each state. All of state regulations interrelate with Federal regulations and may be in conflict with them. Laws such as the Clean Water Act and the Public Utilities Regulatory Policies Act have particular impact. (Brambley-SRC)
W82-00448

**SUMMARY OF THE MIDWEST CONFERENCE ON SMALL-SCALE HYDROPOWER IN THE MIDWEST: AN OLD TECHNOLOGY WHOSE TIME HAS COME.**
Franklin Pierce Law Center, Concord, NH. Energy Law Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/RA/04934-05, Price codes: A07 in paper copy, A01 in microfiche. Department of Energy Report DOE/RA/04934-05, May 1980. 147 p, 4 Fig, 3 Tab, 3 Ref.

Descriptors: *Legal aspects, *Hydroelectric plants, *Economic aspects, *Institutional constraints, Computer models, Financing, Permits, Licensing, Dams, Midwest.

The conference focused on the legal and institutional barriers to small scale hydroelectric dam development in the Mid-west. Two of the workshop sessions discussed problems and policy responses raised by state and federal regulation, while the remaining two dealt with economic issues confronting small scale hydroelectric development and the operation and usefulness of the systems dynamics model developed by the Thayer School of Engineering. The main problems with state regulation concern the time spent on obtaining a permit and the unnecessary duplication of effort because of overlapping or parallel federal requirements. There is a need for a simplified and expeditions licensing process coordinated by a

single licensing agency. Central to the issues surrounding federal regualtion was the need to coordinate state and federal activities. It was suggested that the following features be added to the systems dynamics model: inflationary effects of licensing delays; individuals developing small scale hydroelectric sites; impacts of state laws and administration; cost of complying with federal regulations; national costs of policies as well as small scale hydroelectric development benefits; competition among various types of developers to develop a site; and impact of coordinated use of a series of dams. A major economic issue is the price to be paid to the small developer for power. Financing small scale hydroelectric projects is another major issue. Although hydroelectric generation has proven to be reliable, the overall risk of any small scale hydroelectric development is high, due to the leverage ratio, payback period and overall return, institutional uncertainties and form of power sales. (Moore-SRC)
W82-00449

**LEGAL OBSTACLES AND INCENTIVES TO THE DEVELOPMENT OF SMALL SCALE HYDROELECTRIC POWER IN KENTUCKY.**
Franklin Pierce Law Center, Concord, NH. Energy Law Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/RA/04934-10, Price codes: A06 in paper copy, A01 in microfiche. Department of Energy Report DOE/RA/04934-10, May 1980. 106 p, 118 Ref.

Descriptors: *Hydroelectric plants, *Legal aspects, *Water rights, *Dams, Institutional constraints, Water rights, Riparian rights, Water quality, Construction, Taxes, Financing, Utilities, *Kentucky.

Development of small scale hydroelectric sites in Kentucky involves interaction with all levels of government; Federal, State and local. The developer must not only obtain the rights to the dam structure itself and the land it is on, but must also obtain the rights to receive and impound the water, to raise and lower the water level in the reservoir, and the right to run transmission lines across neighboring land. In Kentucky, a riparian owner may not unreasonably change the natural flow of water so as to cause substantial damage to a lower riparian owner. Riparian rights on a navigable watercourse are subordinate to the public rights to navigate such waters and to make improvements in aid of such navigation. A stream is navigable by law in Kentucky if it can float logs downstream during spring high waters. The most significant department concerned with dam construction, maintenance and operation is the Department for Natural Resources and Environmental Protection (NREP). NREP has the power to prevent, abate and control water pollution. The Secretary of the department is authorized to examine and approve or disapprove all applications for dam construction permits not otherwise excepted, and establishes standards for dam safety. All energy utilities are subject to the various requirements of the Energy Commission, but developers of hydroelectric power for wholesale use or for their own are not subject to the Energy Commission. Loans or grants may be available from the Kentucky Development Finance Authority, and Business Development Corporations. The hydroelectric developer will have to pay property taxes, income taxes, and sales taxes, as well as special taxes for dealing in electricity. (Moore-SRC)
W82-00450

**WATER REGULATIONS,**
J. Josephson.
Environmental Science and Technology, Vol 15, No 6, p 620, 1981.

Descriptors: *Federal jurisdiction, *Water quality standards, *Water pollution control, Economic aspects, Cost analysis, Legal aspects, Regulations, Pollutants.

Many proposed revisions to the Clean Water Act will be reviewed by the Congress when the Act is considered for reauthorization in 1981. These proposed revisions are designed to increase the flexibility and enhance the cost-effectiveness of water pollution criteria and standards. This would be accomplished primarily by ending the application of uniform criteria and standards to all water bodies and substituting regulations which consider the nature and uses of the receiving water, including the ability of the waterway to handle pollutants. Other suggestions include greater input by scientists into the development and documentation of standards and increased responsibility on the part of the states for water quality control, with a reduced Federal role. Increased consideration of cost-benefit relationships is also encouraged. (Carroll-FRC)
W82-00482

## 6F. Nonstructural Alternatives

**FLOOD FORECAST AND WARNING SYSTEM EVALUATION, SUSQUEHANNA RIVER BASIN, NEW YORK, PENNSYLVANIA AND MARYLAND.**
Susquehanna River Basin Commission, Harrisburg, PA.
Report prepared for Army Corps of Engineers, Baltimore District, January, 1979. 137 p, 11 Fig, 8 Tab, 49 Ref, 5 Append.

Descriptors: *Flood forecasting, *Flood protection, *Warning systems, Flood damage, Reservoir operation, Flood control, Communication, Nonstructural alternatives, Data collections, Flash floods, *Susquehanna River basin, New York, Pennsylvania, Maryland.

Following the devastation resulting from Tropical Storm Agnes in June, 1972, the Corps of Engineers was directed to conduct a Flood Control Review Study of the Susquehanna basin to determine if any improvements or additions to the existing flood control system would be feasible. Flood forecasting and warning is evaluated as a flood damage reduction alternative for this basin. The river flood forecasting and warning system is operated to provide advance warning of flooding conditions which threaten human life and can cause property damage. The components of the system, some of which are operated by different levels of government, are: data collection; data assembly; forecast preparation; forecast dissemination; reservoir regulation; and local action. Problems or areas of concern identified in the Susquehanna River basin flood warning system include; speeding up the river forecasting process; increasing the reliability of the river forecasting system; improving flash flood warning; improving local response; and providing ongoing review of the forecasting system. The existing river forecasting system is too slow to provide timely flood forecasts for upstream areas on main rivers. It sometimes takes over 6 hours to assemble data, transfer it to the forecast center, prepare a forecast and disseminate it. A serious deficiency is the failure of the telephone communications system and its disruptive effect on the forecast system. (Moore-SRC)
W82-00351

## 6G. Ecologic Impact Of Water Development

**WATER QUALITY MANAGEMENT STUDIES, LAKE SEMINOLE, APRIL-NOVEMBER 1978.**
Corps of Engineers, Mobile, AL. Mobile District.
Technical Publication ACF80-10 (Final Report), September 1981. 519 p, 4 Fig, 16 Tab, 70 Ref, 13 Append.

Descriptors: *Water quality management, *Reservoirs, *Hydrologic data, *Sediments, *Biological samples, Limnology, Eutrophication, Turbidity, Iron, Mixing, Nutrients, Productivity, Zooplankton, Algal growth, Climatology, Biomass, Reservoir operation, Macrophytes, *Lake Seminole, Tributaries, Georgia, Florida, Alabama.

The purpose of Phase I was the establishment of a comprehensive water quality, sediment, and biological data base at various sites within the impoundment, in the backwater stretches of the major tributaries, and immediately downstream of the outfall on the Apalachicola River. This data base is to be utilized for the combined purposes of future reference, guidance in the improvement of reservoir operations, facilitation of coordination with state agencies in the implementation of watershed pollution control measures, and identification of significant water quality problems. Meteorological, hydrological, water quality, sediment, and biological data were obtained at a total of 19 main sampling stations in Lake Seminole, the Chattahoochee River, the Flint River, Spring Creek, Fish Pond Drain, and the Apalachicola River during 6 sampling cycles from April 17, 1978 through November 30, 1978. The Chattahoochee River accounted for 60-80% of the flow into the impoundment. As a result of operational procedures at the Walter F. George Lock and Dam on the Chattahoochee River upstream of Lake Seminole, flows through the Chattahoochee River impoundment arm exhibited considerable short term variation. Each of the major impoundment arms of Lake Seminole tended to be well-mixed both laterally and vertically. Average turbidity levels in the Chattahoochee River were approximately three times those in the Flint River. Concentrations of total iron at most stations during the spring and early summer months exceeded the EPA criterion of 1.0 mg/l. Based on nutrient content, the waters of Lake Seminole tended to be moderately high to highly productive with respect to the production of algal biomass. Zooplankton assemblages exhibited little variation in the number of taxa found at each station during the year. Aquatic macrophytes constituted the most conspicuous feature of Lake Seminole. Emergent and floating macrophytes covered over 40% of the total surface and nearly 100% of the surface with a depth less than 2 m. (Moore-SRC)
W82-00051

**EFFECT OF MICROCRUSTACEANS ON BLUE-GREEN ALGAE IN FLOODED SOIL,**
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
J. T. Wilson, S. Greene, and M. Alexander.
Soil Biology and Biochemistry, Vol 12, No 3, p 237-240, 1980. 2 Tab, 7 Ref.

Descriptors: Eutrophication, *Floodwater, *Crustaceans, Cyanophyta, Water pollution effects, *Rice, Algae, Ostracods, Waterfleas, Nitrogen, Insecticides, Grazing, *Nitrogen fixation, Soil types, Soil water, *Algal control, Grazing.

In lowlands rice paddies, nitrogen-fixing algae can be an important source of nitrogen. Grazing by microcrustaceans and other fauna of flooded soil may limit the extent of algal development and affect the amount of nitrogen fixed by the algae. Previous studies have shown that the use of lindane or parathion kills the microcrustaceans and allows algal growth to flourish. Laboratory experiments were conducted to assess the effects of controlled numbers of ostracods and waterfleas (Daphnia magna) on the growth rate and nitrogen-fixing activity of Tolypothrix tenuis and Anabaena sp. When present in large numbers, grazing ostracods suppressed growth of Anabaena sp. on flooded soil and prevented the development of T. tenuis. Large numbers of D. magna had only a slight effect on the growth rate and development of these nitrogen-fixing algae. T. tenuis was more susceptible than Anabaena sp. to the grazing of these microcrustaceans. It was suggested that microcrustaceans may play a significant role in the nitrogen fixation by algae in lowland rice growing areas. (Geiger-FRC)
W82-00146

**DOMESTIC WATER SUPPLIES FOR POWER PLANT COOLING,**
Technion-Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 6D.
W82-00180

**POWER PLANT WATER INTAKE ASSESSMENT,**
Consumers Power Co., Jackson, MI.
I. H. Zeitoun, J. A. Gulvas, and J. J. Rochow.

Environmental Science and Technology, Vol 14, No 4, p 398-402, April, 1980. 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Power plants, *Environmental effects, Vegetation effects, Aquatic life, Fish, Entrainment, Impingment, Economic aspects, Decision making, Planning, Legal aspects, Regulations, *Intakes, Water intake, *Ecological effects, Ecosystems.

The total assessment of the impact of water intake by power plants should be related to its total effect on the ecological system, not solely on the numbers or weights of aquatic organisms impinged or entrained. The lack of emphasis on this aspect in the Federal Water Pollution Control Act (FWPCA) and the lack of an established set of criteria to explain or define acceptable limits of environmental impact creates perplexing situations. Alternative cooling schemes must be evaluated and compared as to their effects on all ecosystems. Acceptability of an intake should be based on prediction or detection of significant adverse changes or disruption at the ecosystem level. In many cases power plant effects are isolated and the stresses imposed on aquatic life are ignored. Attempts have been made to integrate the biotic and economic values in order to compare the environmental impact potential with the cost of an offshore intake. In examining 20 Lake Michigan power plants via this economic approach, the value of fishes lost was found to represent less than 1% of the established commercial value of fish landed during the time of the evaluation. It is concluded that the ability of the environment to resist perturbation and the existence of indigenous compensatory mechanisms must be taken into account as part of the decision making progress related to power plant operation. (Baker-FRC)
W82-00216

**FINAL ENVIRONMENTAL IMPACT STATEMENT; DINKEY CREEK PROJECT NO. 2890 - CALIFORNIA.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation. Report FERC/EIS-0010, August 1980. 302 p, 21 Fig, 35 Tab, 56 Ref, 11 Append.

Descriptors: *Environmental impact statement, *Hydroelectric plants, *Dam effects, *Construction, Water quality, Turbidity, Wildlife habitats, Water pollution sources, Fish populations, Reservoirs, Benthic fauna, Spoil disposal, Planning, *Dinkey Creek project, *California.

The conventional hydroelectric project proposed for construction on Dinkey Creek, Fresno County, California would consist of: a dam and reservoir on Dinkey Creek; a power tunnel; two powerhouses; three diversion tunnels; access road; recreational facilities; and other appurtenant facilities. The total installed capacity would be 120 megawatts. Environmental impacts caused by construction and operation of the project would include: increased turbidity and loss of benthic invertebrates and fish in portions of Dinkey Creek and the diversion tributaries during construction; alteration of approximately 1,176 acres of upland valley topography; loss of productive timber land and wildlife habitat; disturbance to the existing recreational setting while construction is underway; and inundation of archeological resources. The introduction of large quantities of suspended sediments into Dinkey Creek and tributaries from excavating tunnels and from spoil deposition areas would have the greatest impact on the water quality of the project. During tunnel excavation, drilling operations would require cooling water that would be characterized by high concentrations of hydraulic oil, cement, and inorganic materials after use. In addition, ground water encountered during drilling would compound the water quality problem. (Moore-SRC)
W82-00352

**FINAL ENVIRONMENTAL IMPACT STATEMENT; TERROR LAKE PROJECT NO. 2743 - ALASKA.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation. Report FERC/EIS-0026, August, 1981. 393 p, 43 Fig, 16 Tab, 59 Ref, 8 Append.

Descriptors: *Environmental impact statement, *Dam effects, *Construction, *Environmental effects, Reservoirs, Wildlife habitats, River flow, Water temperature, Diversion dams, Planning, *Terror Lake, Kodiak, *Alaska.

Kodiak Electric Association proposes to construct a 20-MW conventional hydroelectric project by using the hydroelectric potential of Terror Lake, a natural lake located in a glaciated valley, 25 miles southwest of the City of Kodiak, Alaska. The proposed development would require the construction of a 156-foot high rockfill dam, 2,100 feet in length. The 270-acre natural lake would be inundated and replaced by an 850-acre reservoir. During project operation, water would be diverted from Terror Lake Reservoir and Falls, Shotgun, and Rolling Rock Creeks, through the power tunnel and penstock, to turn generators in the powerhouse that would be located on the Kizhuyak River. Approximately 1,878 acres of land and 270 water surface acres within the Kodiak National Wildlife Refuge would be included in the project. Significant environmental impacts of the proposed project include: loss of approximately 1,080 acres of wildlife habitat; human intrusions and construction activities within the wildlife refuge; flow in the Terror River immediately below the dam would be reduced by up to 90%; reduced flows in the Kizhuyak River from the Shotgun and Falls Creeks Diversion Dams downstream to the powerhouse; alteration of the thermal regime of the Terror and Kizhuyak Rivers. The design of the proposal is considered to be environmentally superior to that of either of the proposed alternatives. (Moore-SRC)
W82-00353

**FINAL ENVIRONMENTAL IMPACT STATEMENT; TYEE LAKE PROJECT FERC NO. 3015 - ALASKA.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation. Report FERC/EIS-0023, June, 1981. 224 p, 24 Fig, 17 Tab, 25 Ref, 6 Append.

Descriptors: *Environmental impact statement, *Hydroelectric plants, *Construction, Wildlife, Aquatic habitats, Water temperature, Wetlands, Environmental effects, Flow discharge, Water conveyance, Intakes, Transmission lines, Planning, Baseline studies, *Tyee Lake Project, Wrangell, *Alaska.

The proposed 20 MW hydroelectric project on Tyee Creek in Tongass National Forest near Wrangell, Alaska, would require: a lake tap intake structure in Tyee Lake at approximately 1,230 ft elevation; approximately 8,700 ft of shaft and tunnel for water conveyance; a powerhouse near the Bradfield Canal; approximately 1,100 ft of channel from the powerhouse tailrace to Airstrip Slough; 69 miles of overhead and 12 miles of submarine transmission line; approximately 1 mile of access road; and other appurtenant facilities. Development of the proposed Tyee Lake Project would result in the following unmitigated environmental impacts: removal of 490 acres of commercial forest land; some degradation of visual resources related to the proposed transmission line; up to a 92% reduction in the discharge to Tyee Creek, and associated reduction in aquatic habitat; changes in the thermal regime of Airstrip Slough; disturbance of wetlands near Airstrip Slough; and human intrusion on wildlife resources during construction. The Tyee Lake Project is recommended as proposed, with mitigative measures. (Moore-SRC)
W82-00354

**FINAL ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED SEWERAGE FACILITIES IN THE MARION COUNTY LAKE IMPROVEMENT DISTRICT, MARION COUNTY, KANSAS.**
Environmental Protection Agency, Kansas City, MO. Region VII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-160145, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-907/9-80-004, December, 1980. 246 p, 12 Fig, 30 Tab, 80 Ref, 5 Append.

Descriptors: *Environmental impact statement, *Marion County Lake, Kansas, *Sewer systems, *Wastewater facilities, *Domestic wastes, Storage tanks, Septic tanks, Economic impact, Environmental effects, Social impact, Water quality, Population dynamics, Leachates, Flora, Fauna, Hydrology, Geology, Soils.

The Marion County Lake Improvement District is a small residential community, surrounding the 150 acre lake, in which the sewerage facilities consist entirely of on-site systems - septic tanks, holding tanks, and privies. This Environmental Impact Statement examined five alternatives for the improvement of sewerage facilities: no action; facility plan; down-sized facility plan; down-sized total retention lagoon; and limited public on-site systems. The environmental, social, and economic impacts of each of these alternatives were evaluated, along with appropriate mitigation measures. Extensive investigations were conducted into population projections; hydrology, geology, and soils; flora and fauna; septic leachate; and cost effectiveness. Based on these investigations the EPA has determined that sufficient water quality problems do not exist to merit funding under the Construction Grants program of the Clean Water Act of 1977, and therefore no further grant will be awarded for this project. (Brambley-SRC)
W82-00355

**FINAL ENVIRONMENTAL IMPACT STATEMENT, CITY OF PORTAGE WASTEWATER SYSTEM, COLUMBIA COUNTY, WISCONSIN.**
Environmental Protection Agency, Chicago, IL. Region V.
Report, July, 1980. 362 p, 23 Fig, 31 Tab, 142 Ref, 6 Append.

Descriptors: *Environmental impact statement, *Portage, Wisconsin, *Secondary wastewater treatment, *Wastewater facilities, *Wastewater disposal, Air pollution, Geology, Soils, Groundwater, Flora, Fauna, Surface water, Land use, Flood plains, Social impact.

A 201 Facilities Plan was prepared for Portage, Wisconsin, that concluded that a new secondary treatment facility adjacent to the Wisconsin River was necessary to replace the old and hydraulically overloaded facility now located on the Fox River. The Environmental Impact Statement addresses the impacts on the environment that would result from each of eight alternate sites, and the cost for each site. The environmental parameters considered are air quality and sound; geology, soils, and groundwater; surface waters; terrestrial and aquatic flora (including wetlands); terrestrial and aquatic fauna; cultural resources; socioeconomic characteristics; agricultural land and land use; flood plains; and energy and chemical requirements. It is concluded that secondary effluent should be discharged to the Wisconsin River from a new site which avoids destruction of wetlands and other environmental problems. Some mitigative measures are recommended to overcome problems resulting from heavy metals, residual PCB sources, and construction dust, noise, nuisance, erosion and sedimentation. An archaeological survey was used to identify historic places likely to be affected by waste facility construction. (Brambley-SRC)
W82-00356

**FINAL ENVIRONMENTAL IMPACT STATEMENT FOR WASTEWATER TREATMENT FACILITIES; CITY OF OLATHE, JOHNSON COUNTY, KANSAS.**
Environmental Protection Agency, Kansas City, MO. Region VII.
For primary bibliographic entry see Field 5D.
W82-00357

**FINAL ENVIRONMENTAL IMPACT STATEMENT; BEMIDJI WASTEWATER TREATMENT SYSTEM, BELTRAMI COUNTY, MINNESOTA.**

Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5D.
W82-00358

**FINAL ENVIRONMENTAL IMPACT STATEMENT; WASTEWATER TREATMENT FACILITIES, SOUTH SHORE LAKE TAHOE BASIN.**
Environmental Protection Agency, San Francisco, CA. Region IX.
For primary bibliographic entry see Field 5D.
W82-00359

**FINAL ENVIRONMENTAL IMPACT STATEMENT; SLUDGE DISPOSAL AND LAND RECLAMATION IN FULTON COUNTY, ILLINOIS.**
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5E.
W82-00360

**FINAL ENVIRONMENTAL IMPACT STATEMENT; REHABILITATION OF WASTEWATER FACILITIES, STREATOR, ILLINOIS.**
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5D.
W82-00361

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 1: CRYSTAL LAKE AREA SEWAGE DISPOSAL AUTHORITY, BENZIE COUNTY, MICHIGAN.**
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5D.
W82-00362

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 2: THE GREEN LAKE SANITARY SEWER AND WASTE DISTRICT, KANDIYOHI COUNTY, MINNESOTA.**
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5D.
W82-00363

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 3: SPRINGVALE-BEAR CREEK SEWAGE DISPOSAL AUTHORITY, EMMET COUNTY, MICHIGAN.**
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5D.
W82-00364

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 4: STEUBEN LAKES REGIONAL WASTE DISTRICT, STEUBEN COUNTY, INDIANA.**
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5D.
W82-00365

**FINAL ENVIRONMENTAL IMPACT STATEMENT; ALTERNATIVE WASTEWATER TREATMENT SYSTEMS FOR RURAL LAKE PROJECTS; CASE STUDY NO. 5: OTTER TAIL COUNTY BOARD OF COMMISSIONERS, OTTER TAIL COUNTY, MINNESOTA.**
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5D.
W82-00366

**FINAL ENVIRONMENTAL IMPACT STATEMENT; SOUTH FORK AMERICAN RIVER DEVELOPMENT, UPPER MOUNTAIN PROJECT NO. 2761 - CALIFORNIA.**
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
Report FERC/EIS-0020, May 1981. 304 p, 37 Fig, 43 Tab, 141 Ref, 6 Append.

Descriptors: *Environmental impact statement, *Hydroelectric plants, *Dam effects, Construction, *Conveyance structures, Reservoirs, Fish populations, Social aspects, Economic aspects, Wildlife habitats, Dam construction, Environmental effects, Recreation facilities, Stream discharge, Sedimentation rates, Planning, *South Fork American River Project, *California.

El Dorado County Water Agency and El Dorado Irrigation District filed an application for a license for the proposed South Fork American River Development, Upper Mountain Project, a conventional hydroelectric and water supply project. The issuance of a license would authorize the construction of: two major diversion structures (dams), one each on the upper South Fork American River and the Silver Fork American River; seven minor diversion structures on tributaries of the South and Silver forks of the American River; a major diversion structure and storage reservoir on Alder Creek; approximately 34 miles of water conveyance structures; three powerhouses; approximately 29 miles of transmission lines; three new access roads; new and improved recreational facilities; and other appurtenant facilities. The total installed generating capacity would be 110.4 MW, with an annual average generation of approximately 470,000 MWh. Environmental impacts caused by construction and operation of the project would include: alteration of existing stream hydraulic parameters, flow rates, sedimentation rates, water temperatures, species composition, and growth and population sizes of fish; the withdrawal of approximately 2850 acres from timber production; the permanent loss of approximately 2000 acres of wildlife habitat; possible decrease in the population size of at least one deer herd; disturbance to existing recreational use of the area during construction; disturbance of normal highway traffic during construction; temporary impacts to air quality and ambient noise levels during construction; direct and indirect impacts to cultural resource sites, direct and indirect socioeconomic effects in El Dorado County; and changes in the characteristics of visual and recreational resources. (Moore-SRC)
W82-00367

**FINAL ENVIRONMENTAL IMPACT STATEMENT; SOUTH TAHOE PUBLIC UTILITY DISTRICT AND DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT NO. 1, APPENDIX B: MITIGATION PROGRAM.**
Sedway/Cooke, San Francisco, CA.
Environmental Protection Agency Report, May 1981. 439 p.

Descriptors: *Environmental impact statement, *Lake Tahoe, California, *Environmental protection, *Wastewater facilities, Erosion control, Runoff, Land use, Forest management, Water quality control, Monitoring, Environmental quality.

The Mitigation Task Force, which was created to coordinate the actions of the agencies with authority to reduce the environmental impacts of the proposed expansion of the South Tahoe Public Utility District, has identified 97 measures to be implemented by 28 agencies. The measures and the agency responsible for implementation of each measure are presented in a matrix. There are 13 areas of impact: water resources and water quality; geology and soils; biology; noise; meteorology and air quality; visual resources; land use and housing; transportation; recreation; public services/fiscal concerns; utilities; cultural, archeological and historical resources; and the Carson Valley. In the water resources and quality category there are sixteen required measures in the areas of erosion and drainage projects, on-site runoff controls, development restrictions, and forest practices; and one recommended measure, monitoring. For each measure, the statements of the responsible agencies are given, and implementation statements from all agencies are also presented. (Brambley-SRC)
W82-00369

# 7. RESOURCES DATA

## 7A. Network Design

**EVALUATION OF GROUND-WATER MONITORING NETWORK, SANTA CRUZ COUNTY, CALIFORNIA,**
Geological Survey, Menlo Park, CA. Water Resources Div.
G. G. Blankenbaker, and C. D. Farrar.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $7.50 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 81-139 (WRI), April 1981. 20 p, 1 Fig, 2 Plates, 6 Tab, 10 Ref.

Descriptors: *Groundwater, *Network design, *Monitoring, *Water quality, Observation wells, Water level, Groundwater storage, Saline water intrusion, Forecasting, Evaluation, *California, *Santa Cruz County.

The Santa Cruz County Flood Control and Water Conservation District seeks to improve the existing network of observation wells to monitor water levels and ground-water quality in the Pajaro Valley subarea and the Aptos-Soquel, San Lorenzo, and Santa Cruz Coastal subbasins in California. The proposed network, consisting of 92 wells, is designed to monitor changes in storage and quality of ground water resulting from climatic changes and management-induced stresses. In the proposed network, water levels in all wells would be measured semiannually, in April and September, and monthly in a few key wells. The water-level measurements would provide data that could be used to determine changes in ground-water storage. In addition to the currently monitored characteristics--temperature, specific conductance, pH, and chloride ion concentration--inclusion of annual sampling and analysis for major ions and nutrients is proposed. The network would also include sampling and analysis for trace elements once every 4 years. More frequent analyses are proposed in areas where water-quality problems are known to exist or where potential water-quality problems are recognized. Analyses for major ions, nutrients, and trace elements are included in the proposed network to provide baseline data for monitoring long-term changes in water quality and to detect any unexpected changes in quality. (USGS)
W82-00023

**PROPOSED OBSERVATION-WELL NETWORKS AND GROUND-WATER LEVEL PROGRAM FOR NORTH CAROLINA,**
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 4B.
W82-00426

## 7B. Data Acquisition

**A QUALITATIVE APPRAISAL OF THE HYDROLOGY OF THE YEMEN ARAB REPUBLIC FROM LANDSAT IMAGES,**
Geological Survey, Reston, VA. Water Resources Div.
M. J. Grolier, G. C. Tibbitts, Jr, and M. M. Ibrahim.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $18.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-565, 1981. 103 p, 6 Fig, 1 Plate, 2 Tab, 34 Ref, 3 Append.

Descriptors: *Arid lands, *Remote sensing, *Foreign research, *Drainage systems, Land use, Irrigation effects, Vegetation, Ephemeral streams, Intermittant streams, Surface-groundwater relations, Groundwater potential, Water quality, Hydrologic cycle, Evaluation, Water resources development, Planning, *Yemen Arab Republic, Landsat, Arabi-

an Peninsula, Red Sea, Tihama, Satellite technology.

Six series of Landsat-1 and Landsat-2 images taken between 1972 and 1976 were analyzed to describe the flow regimens of streams and the regional distribution of vegetation in the Yemen Arab Republic. The findings provide a factual basis for planning a surface-water data collection program, and for preparing maps of plant distribution and agricultural land use. They lay the foundation for modernized water development, for effecting a program of country-wide water management. The work was undertaken as part of the program of the U.S. Agency for International Development with the cooperation of the Yemen Mineral and Petroleum Authority, Ministry of Economy. A false-color composite mosaic of the nine images which cover the country was prepared using Landsat 1 images taken at relatively low sun-angle in winter 1972-73. Catchment areas and the major drainage basins of the country were delineated on this mosaic. In order of increasing water availability, the four catchment areas of the YAR are: Ar Rub al Khali, Wadi Jawf (Arabian Sea), Red Sea, and Gulf of Aden. Most streams are ephemeral. No lakes were detected during the period under investigation, but sebkhas--salt flats or low salt-encrusted plains--are common along the Red Sea coast. In spite of resolution and scale constraints, streamflow was interpreted as perennial or intermittent, wherever it could be detected on several Landsat images covering the same scene at seasonal or yearly intervals. Much of the land under cultivation is restricted to valley floors, and to valley slopes and irrigated terraces adjacent to stream channels. Little or no vegetation could be detected over large regions of the Yemen Arab Republic. (USGS)
W82-00022

**SEASAT SAR RESPONSE FROM WATER RESOURCES PARAMETERS,**
Texas A and M Univ., College Station. Remote Sensing Center.
B. J. Blanchard, A. J. Blanchard, S. W. Theis, W. D. Rosenthal, and C. Jones.
Final Report 3891, June, 1981. 41 p, 11 Fig, 1 Tab, 7 Ref.

Descriptors: *Soil water, *Remote sensing, Flooding, *Satellite technology, Forests, Corn, Alfalfa, Milo, *Vegetation, Radar, Agriculture, Furrows.

An initial investigation of the SEASAT synthetic aperture radar (SAR) data was directed toward estimation of soil moisture; vegetation type, surface roughness due to tillage and flood extent under forest canopy. The SAR response was validated with a series of data sets from an L-band scatterometer flown in the NASA C-130 aircraft. Soil moisture in the surface 15 cm from fields of milo, alfalfa and bare soil produce similar differences (9 db range) in the scattering coefficient from both systems. Most agricultural vegetation was effectively transparent and was penetrated by this wave-length. Corn produces exceptionally high returns; however, there was evidence that tillage roughness could be detected through the corn canopy. Forest canopy, in contrast, produces moderate returns except when the forest floor is flooded. Flooded forest produced 3 to 6 db higher scattering coefficients than non-flooded forest for both the SAR and scatterometer. There was no detectable difference in response from conifer and deciduous forest canopy. Circular tillage patterns were used to illustrate the look angle dependence of row direction effects on the radar return. Roughness due to tillage can produce as much as 12 db increase in return. The SEASAT SAR produced valuable information and in some instances would enable estimates of parameters that are not feasible with any other known system.
W82-00101

**SEDIMENT TRAP DYNAMICS AND CALIBRATION: A LABORATORY EVALUATION,**
Lamont-Doherty Geological Observatory, Palisades, NY.
W. Gardner.
Journal of Marine Research, Vol 38, No 1, p 17-39, 1980. 5 Fig, 5 Tab, 41 Ref.

Descriptors: *Sediments, *Experimental design, Calibration, Turbulence, *Particle size, *Trap efficiency, Lakes, Estuaries, Laboratory equipment, Technology, Trapping, Flow, Currents, Fluvial sediments, Deposits.

The flow dynamics and particle trapping characteristics of several designs of sediment traps were investigated using dye, seawater, and deep sea lutite in a recirculating flume and fish tank at velocities of 0, 4, and 9 cm per second. Particles are collected through a process of fluid exchange rather than by falling into the trap. The efficiency of the trap is therefore a function of the residence time and circulation pattern of fluid, processes controlled by trap geometry and current velocity. Cylinders trap particles in the closest agreement with the sediment deposition rate in the flume. Funnels undertrap, but their efficiency may be improved with baffles at the top of the funnel. Containers with narrow mouths and wide bodies overtrap at an unpredictable rate. (Titus-FRC)
W82-00104

**FIELD ASSESSMENT OF SEDIMENT TRAPS,**
Lamont-Doherty Geological Observatory, Palisades, NY.
W. D. Gardner.
Journal of Marine Research, Vol 38, No 1, p 41-52, 1980. 7 Fig, 1 Tab, 13 Ref.

Descriptors: *Sediments, Trapping, *Trap efficiency, On-site tests, *Particle size, *Flumes, Field tests, Flow, Velocity, Calibration, Funnels, Coastal waters, Tidal effects, Currents, Water sampling, Harbors.

Sediment traps whose particle collection abilities had been calibrated in a laboratory flume at velocities of 0, 4, and 9 cm per second were deployed in natural bodies of water to intercalibrate larger traps under current conditions ranging from tranquil to over 20 cm per second. For cylinders, the height to width ratio is the controlling factor for the mass of sediment collected. Traps can be scaled up in size and maintain a similar collection rate. Increasing current velocity will alter the collection rate of a trap in a manner which depends on the trap geometry. The size distribution of particles collected in traps is biased by trap geometry, with overefficient traps collecting more fine particles. (Titus-FRC)
W82-00105

**AN AQUATIC RESPIROMETER FOR USE IN SUBLETHAL STUDIES,**
Environmental Sciences Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 5C.
W82-00122

**MEASURING FLUMES OF SIMPLIFIED CONSTRUCTION,**
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
J. A. Replogle, and A. J. Clemmens.
Transactions of the ASAE, Vol 24, No 2, p 362-366, 374, March-April, 1981. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Flumes, Flow measurement, Water measurement, Irrigation canals, Mathematical models, Channel flow, Water flow.

Mathematical modeling has provided information for design and construction of a simplified measuring flume for irrigation channels. The flumes are designed for the canal, rather than vice versa. The flumes have high submergence limits and can be used on canals that cannot tolerate much head loss. Portable aluminum or precast flumes have been constructed and installed. Three standard-sized flumes were developed for each of three canal shapes for a normal flow range, 20 to 500 liters per sec. These flumes cost about one-tenth as much as previously used measuring structures. (Cassar-FRC)
W82-00140

**A MORE VERSATILE SOIL WATER SAMPLER,**
North Central Forest Experimental Station, Grand Rapids, MN.
M. D. Knighton, and D. E. Streblow.
Soil Science Society of America Journal, Vol 45, No 1, p 158-159, 1981. 1 Fig, 3 Ref.

Descriptors: *Soil water, *Sampling, *Measuring instruments, Nutrients, Leachates.

The development of a versatile ceramic-cup soil water sampler which overcomes some of the limitations of previous models is reported. Having no rigid parts extending above the soil surface, this new model may be installed at shallow depths prior to such disruptive plot activities as logging which would normally destroy earlier models. The ceramic cup of the new sampler may be positioned within a few centimeters of the soil surface without the problems of instability or flow of surface water down the side of the sampler which occurred with previously existing models. Location of the ceramic cup above the sampler reservoir prevents the reverse flow of soil water through the cup which occurs if the soil dries during the sampling interval. Disadvantages of the new sampler include the need for a larger and deeper hole for installation than was necessary with the earlier sampler, resulting in more soil profile disruption; the possibility that the ceramic cup will dry out more readily because it is not in contact with the collected water; and slightly increased materials, labor, and equipment needs for construction of the sampler. Comparison of the chemistry of soil water samples collected using new samplers and the previously existing samplers indicated no significant differences in the concentrations of nitrogen, phosphorus, potassium, calcium, or magnesium nor in specific conductance. (Carroll-FRC)
W82-00191

**BIONESS, A NEW DESIGN IN MULTIPLE NET ZOOPLANKTON SAMPLERS,**
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
D. D. Sameoto, L. O. Jaroszynski, and W. B. Fraser.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 4, p 722-724, April, 1980. 2 Fig, 3 Ref.

Descriptors: *Biological samples, *Plankton nets, *Measuring instruments, Sampling, Water sampling, *Zooplankton, Nets, Data collections, Marine biology, Temperature, Conductivity, Entrainment.

A new multiple-net zooplankton and micronekton sampler (BIONESS) designed by the Bedford Institute of Oceanography is designed with a horizontal arrangement of nets to reduce the size of the mouth opening and make the structure more streamlined. Ten 1.0 sq m nets open sequentially and are towed at three knots on a conductor cable. The conductor cable is equipped with transmitters and receivers to relay information from the sampler to the ship. Sensors for temperature, conductivity, depth, illumination, pitch, roll, and yaw are featured on the BIONESS sampler along with a camera and internal and external electronic flowmeters. These features enable environmental data to be collected simultaneously with biological samples. The sampler is easier to handle than older models, and its chance for contamination by larger organisms is minimal. (Geiger-FRC)
W82-00210

**REPORT ON THE SUMMER MONEX FIELD PHASE,**
National Science Foundation, Washington, DC.
For primary bibliographic entry see Field 2B.
W82-00265

**POSSIBILITIES OF USING HELIUM AND TRITIUM SURVEYS FOR STUDYING RECHARGE CONDITIONS OF SUBSURFACE WATERS,**
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. L. Zlobina, V. S. Kovalevskii, I. K. Morkovkina, L. K. Ovchinnikova, and V. V. Romanov.

Water Resources (English Translation), Vol 7, No 1, p 73-76, January/February, 1980. 3 Fig, 4 Ref. Translated from Vodnye Resursy, No 1, p 166-170, January/February, 1980.

Descriptors: *Recharge, *Subsurface water, Water, Natural recharge, Groundwater, Helium, *Geohydrology, Tritium, Chemical composition, Chemical analysis, Water analysis, Groundwater movement, *Groundwater recharge, Tracking techniques.

A helium survey was used for detecting areas of water-bearing deposits of sedimentary rocks with maximum permeability in the Moscow territory. The principle of such a survey consists in recording the distribution of concentrations of free, mobile helium, whose main form of migration is seepage with subsurface waters in a dissolved state. Helium concentrations in subsurface waters increase with depth; thus an increase in helium concentration indicates discharge of deeper water-bearing horizons via lithologic windows and tectonic crush zones and by through-flow. A marked decrease proves the existence of inflow of infiltration, river, or ground waters, diluting the background concentrations of this element in the aquifer. Thus on the basis of helium anomalies one can detect recharge areas of the aquifer from above and below and make a quantitative evaluation of the components of the balance of the given aquifer and its change in time under the effect of exploitation of subsurface waters. Water samples were taken in 1978 from water-bearing horizons of Middle and Lower Carboniferous and partially Devonian deposits. Samples for tritium analysis were also taken. It was concluded that the use of helium and tritium surveys in complex hydrodynamic and hydrochemical settings permits the detection of possible recharge areas of subsurface waters and also areas of qualitative change in the chemical composition of these waters as well as the mapping of the contours of areas of possible activation of karst processes. (Baker-FRC)
W82-00302

**AN APPRAISAL OF POND-NET SAMPLES FOR BIOLOGICAL MONITORING OF LOTIC MACROINVERTEBRATES,**
Freshwater Biological Association, Wareham (England).
M. T. Furse, J. F. Wright, P. D. Armitage, and D. Moss.
Water Research, Vol 15, No 6, p 679-689, 1981. 4 Fig, 4 Tab, 22 Ref.

Descriptors: *Sampling, *Macroinvertebrates, *Classification, Monitoring, Invertebrates, Aquatic animals, Benthic fauna, Rivers, Lotic environment, Precision, Pond-net test.

The pond-net technique for sampling benthic macroinvertebrates proved suitable and reliable to use in a British national classification scheme for running water sites. In a field trial, 6 pond-net samples (3 operators, 2 samples each) of 3 min duration were taken at each of 4 sites on the River Axe, England. There were significant differences with respect to sites, operators, and site x operator interactions. There were significant interoperator differences in the number of taxa removed from samples at the family level in the sample processing stage. Nevertheless, at the species level there was strong site faithfulness for each series of 6 samples. A 3 min sample netted 62% of the families and 50% of the species caught in an 18 min sample. The results of this trial confirmed the suitability of the pond-net test for use in the classification exercise, which involves 40-60 biologists, 267 sites, and 41 rivers in Great Britain. (Cassar-FRC)
W82-00308

## 7C. Evaluation, Processing and Publication

**WATER RESOURCES INVESTIGATIONS IN NEW YORK--1980.**
Geological Survey, Albany, NY. Water Resources Div.
Geological Survey Open-File Report 80-1219, 1980. 68 p, 5 Fig, (Compiled by Finch, A.).

Descriptors: Reviews, *Surface water, *Groundwater, *Water quality, Bibliographics, *Projects, Publications, *New York, U.S. Geological Survey, Water Resources Division.

This report describes the water-resources investigations conducted by the U.S. Geological Survey in New York in 1980; many of these studies will continue into 1981 or longer. The Geological Survey began its water-resources studies in New York State in 1895 with a stream-gaging program in the Catskill Mountain region and entered its first cooperative program, with the Office of the State Engineer, in 1900. Since 1910, the Survey has maintained a District office in Albany to direct its water investigations within the State. A Long Island subdistrict office was established in 1932 to monitor and study the ground-water situation in this area of increasing urbanization. Subdistrict offices are also maintained in Ithaca and Albany to collect and interpret data from western and eastern New York, respectively. A field station is maintained in Potsdam to collect records in the northernmost part of the State. A bibliography of reports published or released in 1980 by the New York District is included. (USGS)
W82-00011

**SELECTED HYDROLOGIC DATA, ARKANSAS RIVER BASIN, PUEBLO AND SOUTHEASTERN FREMONT COUNTIES, COLORADO, 1975-80,**
Geological Survey, Lakewood, CO. Water Resources Div.
D. Cain, and P. Edelmann.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $33.50 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-1185, 1980. 233 p, 1 Plate, 20 Tab, 2 Ref.

Descriptors: *Data collections, *Water quality, *Surface water, Discharge measurement, Gaging stations, Traveltime, Nutrients, Pesticides, Trace metals, Chemical analysis, *Colorado, Pueblo County, Fremont County, *Arkansas River basin.

Selcted hydrologic data collected in 1975-80 as part of water-quality investigations by the U.S. Geological Survey in Pueblo and southeastern Fremont Counties, Colo., are presented in this report. The data, in tabular form, consist of streamflow-discharge measurements for 33 sites, channel-geometry measurements for 97 sites, traveltime data for 12 sites, and field and laboratory water-quality analyses for 194 sites. Federal, state, and local officials may find these data useful in making decisions relating to the management of water resources of the area. (USGS)
W82-00020

**WATER RESOURCES OF THE SANTA YSABEL AND MESA GRANDE INDIAN RESERVATIONS, SAN DIEGO COUNTY, CALIFORNIA,**
Geological Survey, Menlo Park, CA. Water Resources Div.
J. R. Freckleton.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $6.25 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 81-342 (WRI), 1981. 27 p, 1 Fig, 1 Plate, 8 Tab, 8 Ref.

Descriptors: *Hydrology, *Geology, *Water resources development, *Water supply, Groundwater, Drillers logs, Wells, Water yield, Springs, Surface water, Streamflow, Precipitation, Water quality, Chemical analysis, Potential water supply, Evaluation, *California, Santa Ysabel Indian Reservation, Mesa Grande Indian Reservation, *Indian reservations, San Diego County.

The Santa Ysabel (consisting of three tracts) and Mesa Grande Indian Reservations are in north-central San Diego County, Calif. On both reservations fractured and weathered igneous and metamorphic rocks and alluvium are water bearing; however, no wells are known to derive their water entirely from alluvium. Well yields range from 2.5 to 250 gallons per minute. Springs occur where saturated fractured or weathered material intersects the land surface. Spring discharge ranged from 0 gallon per minute (November 1979) to 9.4 gallons per minute (November 1979). Few data are available for the surface water characteristics of the study area. One-time measurements of discharge at selected stream sites were made in late November 1979 and late May 1980; discharges ranged from less than 0.01 cubic foot per second to an estimated 3 cubic feet per second. Further study of the surface-water systems would provide a basis for estimating their development potential. The existing water-supply development on the Santa Ysabel Indian Reservation is adequate for the present residents. The Mesa Grande reservation was unoccupied in 1952, was reportedly unoccupied in November 1979, and has no developed water supply. Additional water can be developed for both reservations from the igneous and metamorphic rock, from presently undeveloped springs, and from perennial reaches of the larger streams. Except for excessive iron and sodium at some ground-water sites and excessive sodium at a few surface-water sites, the water is of suitable quality for domestic and agricultural use. (USGS)
W82-00021

**POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT, FLORIDA, MAY 1980,**
Geological Survey, Tallahassee, FL. Water Resources Div.
J. C. Rosenau, and R. S. Milner.
Geological Survey Open-File Report 81-211 (WRI), 1981. 1 Sheet.

Descriptors: *Maps, *Aquifers, *Water level, *Potentiometric level, *Wells, Contours, Water level fluctuations, *Florida, Floridan aquifer, Suwannee River Water Management District.

A May 1980 potentiometric surface map of the Suwannee River Water Management District area, Florida, depicts water levels in wells tapping the Floridan aquifer. Compared to the May 1976 potentiometric map of the area, there are no significant differences in the general appearance of the contours. Water levels, however, are generally about 10 feet higher than in 1976 along the Suwannee River and for some 20 miles west of the river and in Gilchrist and Levy Counties to the east. (USGS)
W82-00024

**POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER IN THE NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT, MAY 1980,**
Geological Survey, Tallahassee, FL. Water Resources Div.
J. C. Rosenau, and R. S. Milner.
Geological Survey Open-File Report 81-205 (WRI), 1981. 1 Sheet.

Descriptors: *Maps, *Aquifers, *Water level, *Potentiometric level, *Wells, Contours, Water level fluctuations, *Florida, Floridan aquifer, Northwest Florida Water Management District.

A May 1980 potentiometric surface map of the Northwest Florida Water Management District depicts water levels in wells tapping the Floridan aquifer prior to summer pumpage. Compared to earlier potentiometric maps of the area, there are no significant differences in the 1980 map that are the result of hydrologic conditions. The addition of numerous new monitor wells in Jackson, Calhoun, Gadsden, and Liberty Counties, however, permitted refinement or better delineation of contours and a separation of water-bearing zones of the Floridan aquifer in the latter two counties. (USGS)
W82-00025

**WATER RESOURCES OF PRINCE WILLIAM FOREST PARK, VIRGINIA,**

Geological Survey, Albany, NY. Water Resources Div.
G. A. Brown.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $2.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 80-964 (WRI), 1981. 2 Sheets, 13 Fig, 13 Ref.

Descriptors: *Maps, *Water supply, *Water quality, *National parks, Geohydrology, Data collections, Groundwater availability, Water level, Groundwater movement, Well yields, Surface water, Flow characteristics, Water use, Recreation facilities, *Virginia, *Prince William Forest Park.

Prince William Forest Park is in the southern part of Prince William County, Va. Its natural beauty and nearness to Washington, D.C. have made it one of the most popular recreation areas in northern Virginia. To help the National Park Service plan the development of new facilities and effectively manage its total resources, the U.S. Geological Survey made a hydrologic study of the park from October 1972 to November 1975. The overall objective of the Survey's study was to evalute the quantity and quality of the park's water resources. Available information was compiled and analyzed, and new data on streamflow, ground-water levels, and the chemical quality of water were collected. Test wells were drilled and aquifer tests made at the sites of wells to evaluate the occurrence and availability of ground water. (USGS)
W82-00026

**WATER RESOURCES DATA FOR NEW HAMPSHIRE AND VERMONT, WATER YEAR 1980.**
Geological Survey, Boston, MA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-110156, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NH-VT-80-1, 1981. 177 p, 3 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *New Hampshire, *Vermont.

Water-resources data for the 1980 water year for New Hampshire and Vermont consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 77 gaging stations, stage records for 3 lakes, monthend contents for 25 lakes and reservoirs, water-quality data for 4 gaging stations, and water levels for 40 observation wells. Also included are data for 4 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States and Province of Quebec are also included in this report. These data represent that portion of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Hampshire and Vermont. (USGS)
W82-00076

**WATER RESOURCES DATA FOR WEST VIRGINIA, WATER YEAR 1980.**
Geological Survey, Charleston, WV. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-111637, Price codes: A21 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WV-80-1, 1981. 475 p, 5 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *West Virginia.

Water resources data for the 1980 water year for West Virginia consist of records of stage, discharge, and water quality of streams and springs; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 117 gaging stations, stage only records for 8 gaging stations, stage and contents for 8 lakes and reservoirs, contents for 1 reservoir, change in contents for 1 reservoir, water quality for 101 gaging stations, and water levels for 37 observation wells. Also included are 5 crest-stage partial-record stations, and 1 low-flow partial record station. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia. (USGS)
W82-00077

**WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1980--VOLUME 1. MISSOURI RIVER BASIN.**
Geological Survey, Lawrence, KS. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-106139, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report KS-80-1, 1981. 422 p, 8 Fig, 4 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Kansas, *Missouri River basin.

Water resources data for the 1980 water year for Kansas, presented in two volumes, consist of records of stage, discharge, and water quality streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells. This volume contains discharge records for 89 gaging stations; stage and contents for 14 lakes and reservoirs; water quality for 49 gaging stations and 2 lakes; and water levels for about 176 observation wells and water quality for about 266 wells. Also included are data for 56 crest-stage partial-record stations. All data in this report represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kansas. (USGS)
W82-00078

**WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1980--VOLUME 2. ARKANSAS RIVER BASIN.**
Geological Survey, Lawrence, KS. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-106147, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report KS-80-2, 1981. 340 p, 8 Fig, 4 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Kansas, *Arkansas River basin.

Water resources data for the 1980 water year for Kansas, presented in two volumes, consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells. This volume contains discharge records for 67 gaging stations; stage and contents for 7 lakes and reservoirs; water quality for 78 gaging stations; and water levels for about 306 observation wells and water quality for about 262 wells. Also included are data for 32 crest-stage partial-record stations and 22 low-flow partial-record stations. All data in this report represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kansas. (USGS)
W82-00079

**WATER RESOURCES DATA FOR TEXAS, WATER YEAR 1979--VOLUME 1. ARKANSAS RIVER BASIN, RED RIVER BASIN, SABINE RIVER BASIN, NECHES RIVER BASIN, TRINITY RIVER BASIN, AND INTERVENING COASTAL BASINS.**
Geological Survey, Austin, TX. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-110479, Price codes: $44.00 in paper copy, A01 in microfiche. Geological Survey Water-Data Report TX-79-1, 1980. 619 p, 1 Fig.

Descriptors: *Hydrologic data, *Surface water, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Data collections, Sites, *Texas, Arkansas River basin, Red River basin, Sabine River basin, Neches River basin, Trinity River basin.

Surface-water data for the 1979 water year for Texas are presented in three volumes, appropriately identified as to content by river basins. Data in each volume consist of records of stage, discharge, and water quality of streams and canals; and stage, contents, and water quality of lakes and reservoirs. Also included are crest-stage and flood-hydrograph partial-record stations, reconnaissance partial-record stations, and low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States are also included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Texas. (USGS)
W82-00080

**WATER RESOURCES DATA FOR TEXAS, WATER YEAR 1979--VOLUME 2. SAN JACINTO RIVER BASIN, BRAZOS RIVER BASIN, SAN BERNARD RIVER BASIN AND INTERVENING COASTAL BASINS.**
Geological Survey, Austin, TX. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-110487, Price codes: A23 in paper copy, A01 in microfiche. Geological Survey Water-Data Report TX-79-2, 1980. 511 p, 1 Fig.

Descriptors: *Hydrologic data, *Surface water, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Data collections, Sites, *Texas, San Jacinto River basin, Brazos River basin, San Bernard River basin.

Surface-water data for the 1979 water year for Texas are presented in three volumes, appropriately identified as to content by river basins. Data in each volume consist of records of stage, discharge, and water quality of streams and canals; and stage, contents, and water quality of lakes and reservoirs. Also included are crest-stage and flood-hydrograph partial-record stations, reconnaissance partial-record stations, and low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States are also included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Texas. (USGS)
W82-00081

**WATER RESOURCES DATA FOR TEXAS, WATER YEAR 1979--VOLUME 3. COLORADO RIVER BASIN, LAVACA RIVER BASIN, GUA-**

**DALUPE RIVER BASIN, NUECES RIVER BASIN, RIO GRANDE BASIN, AND INTERVENING COASTAL BASIN.**
Geological Survey, Austin, TX. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-110495, Price codes: $42.50 in paper copy, A01 in microfiche. Geological Survey Water-Data Report TX-79-3, 1980. 619 p, 1 Fig.

Descriptors: *Hydrologic data, *Surface water, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Data collections, Sites, *Texas, Colorado River basin, Lavaca River basin, Guadalupe River basin, Nueces River basin, Rio Grande basin.

Surface-water data for the 1979 water year for Texas are presented in three volumes, appropriately identified as to content by river basins. Data in each volume consist of records of stage, discharge, and water quality of streams and canals; and stage, contents, and water quality of lakes and reservoirs. Also included are crest-stage and flood-hydrograph partial-record stations, reconnaissance partial-record stations, and low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States are also included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Texas. (USGS)
W82-00082

**HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1979,**
Geological Survey, Austin, TX. Water Resources Div.
R. M. Slade, Jr., M. E. Dorsey, J. D. Gordon, R. N. Mitchell, and J. L. Gaylord.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $36.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-628, May 1981. 281 p, 18 Fig, 17 Tab, 5 Ref.

Descriptors: *Hydrologic data, *Urban hydrology, *Urban runoff, *Rainfall-runoff relationships, *Storm runoff, Streamflow, Flow rates, Watersheds, Groundwater, Water quality, Flood profiles, Flood peak, Watershed management, Data collections, *Texas, Austin, Colorado River.

This report contains rainfall and runoff data collected during the 1979 water year for the Austin, Texas, metropolitan area. In 1975, the program was expanded to include the collection of water-quality data. In 1978, the program was expanded to include a groundwater resources study of the south Austin metropolitan area in the Balcones fault zone. The information will be useful in determining the extent to which progressive urbanization will affect the yeild and mode of occurrence of storm runoff. The major streams in the study area are the Colorado River, Onion Creek, Barton Creek, Walnut Creek, Bull Creek, Boggy Creek, Shoal Creek, Williamson Creek, Slaughter Creek, Bear Creek, and Waller Creek. Detailed rainfall-runoff computations are presented for eight storm periods during the 1979 water year. Water-quality data for sites in the Austin metropolitan area are also given in this report. (USGS)
W82-00083

**PRELIMINARY DATA FROM A SERIES OF ARTIFICIAL RECHARGE EXPERIMENTS AT STANTON, TEXAS,**
Geological Survey, Denver, CO. Water Resources Div.
R. L. Bassett, E. P. Weeks, M. L. Ceazan, S. G. Perkins, and D. C. Signor.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $31.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-149, 1981. 235 p, 38 Fig, 84 Tab, 18 Ref.

Descriptors: *Artificial recharge, *Data collections, *Aquifers, *Hydraulic properties, Sampling, Monitoring, Tracers, Distribution, Organic compounds, Inorganic compounds, Geology, Porosity, Hydraulic conductivity, *Texas, Stanton, Ogallala Formation.

A series of artificial recharge experiments was conducted by the U.S. Geological Survey at an experimental site located in Stanton, Texas. Five tests were performed from March 1977 through December 1978 to: (1) Evaluate the hydraulic properties of the aquifer; (2) test sampling and monitoring equipment; (3) compare tracers for future use in hydrologic investigations; and (4) determine the radial and vertical distribution of hydraulic properties at the site. Suites of inorganic, and both volatile and nonvolatile organic tracers were used in the tests, and comparative data were obtained from sampling points at several radial distances and depths from the injection well. Hydraulic data from aquifer tests and geologic data from core material also were obtained during the investigation. (USGS)
W82-00085

**WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1980,**
Geological Survey, Cheyenne, WY. Water Resources Div.
S. L. Green.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $15.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-201, 1981. 118 p, 11 Fig, 5 Tab.

Descriptors: *Surface water, *Groundwater, *Water quality, *Hydrologic data, Water supply, Streamflow, Sediment transport, Reservoirs, Observation wells, Oil shale, Environmental effects, Publications, Reviews, *Wyoming, Coal regions.

This report contains lists and location maps of streamflow and reservoir stations, ground-water stations, water-quality stations, sediment stations, and peak-flow partial-record stations that are currently being operated in Wyoming. Water-resources appraisal projects are also described, including many that are related to development of energy resources. The general locations of the projects are shown on maps. The U.S. Geological Survey is striving to coordinate its water-resources investigations with those of other agencies. This report is one phase of that coordination effort and serves as an annual progress report to cooperators and the public. (USGS)
W82-00087

**WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN COLORADO--FISCAL YEAR 1981.**
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $19.25 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 81-150, March 1981. 131 p, 45 Fig, 1 Plate, 1 Tab. (Compiled by William E. Price, Jr.).

Descriptors: *Surface water, *Groundwater, *Water quality, Data collections, Maps, *Colorado, Colorado River basin, Missouri River basin, Arkansas River basin, Rio Grande basin.

The report provides an overview of water-resources data collection and hydrologic investigations in Colorado from October 1, 1980, to September 30, 1981. Most of the work is carried out in cooperation with 51 Federal, State, and local agencies. Data are being collected at 503 surface-water gaging stations, 161 surface-water quality stations, and 1,151 observation wells. Sixty-seven hydrologic investigations are underway and are described in the report by a map showing the location of the study area and a statement of the purpose, objective, approach, progress, and plans. Twelve of the investigations are statewide, 6 are regional, 9 are in the Missouri River basin, 8 in the Arkansas River basin, 6 in the Rio Grande basin, and 5 are multistate. Listed in the report are references to 9 data reports and 27 interpretive reports released or published in fiscal year 1980 as a result of water-resources investigations in Colorado. (USGS)
W82-00088

**GEOLOGIC, HYDROLOGIC AND CHEMICAL DATA FROM TEST WELLS IN THE DICKSON AREA, TENNESSEE,**
Geological Survey, Nashville, TN. Water Resources Div.
M. W. Bradley, and J. Jonas.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $1.00 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 81-202, 1981. 1 Sheet, 3 Tab.

Descriptors: *Hydrologic data, *Groundwater, *Water quality, *Test wells, Sites, Water sampling, Well data, Well yield, Physical properties, Chemical properties, Specific capacity, Pumping tests, *Tennessee, Dickson County, Maps.

Seventeen test wells were drilled at 12 sites in south central Dickson County, Tenn. Most of the sites were selected on the basis of carefully developed concepts of groundwater occurrence. These wells range from 20 to 400 feet deep and average 276 feet deep. The yields range from 0 to 300 gal/min and average 69 gal/min, with 6 wells yielding more than 100 gal/min. The water-bearing zones in rock that yield more than 50 gal/min are all between 100 and 200 feet below land surface. Sulfur gas was detected in two of the wells and large concentrations of iron were present in other wells. Capacity tests were conducted on those wells which yield more than 100 gal/min. The specific capacities of these wells range from 1.36 to 8.11 and average 3.46 gal/min for each foot of drawdown. (USGS)
W82-00090

**GEOGRAPHIC INFORMATION SYSTEMS AND ENVIRONMENTAL IMPACT ASSESSMENT,**
Queen's Univ., Kingston (Ontario). Dept. of Geography.
C. Griffith.
Environmental Management, Vol 4, No 1, p 21-25, January, 1980. 4 Fig, 2 Tab, 5 Ref.

Descriptors: *Land use, *Environmental impact statement, *Regional analysis, Recreation, Agriculture, Canada Geographic Information System, Glengowan Dam, Thames River, Ontario, Dams, Reservoirs, Rivers, Planning, Data processing, *Canada.

The Canadian Geographic Information System categorizes land use capabilities into six groups: agriculture, forestry, recreation, wildlife, watershed boundaries, and land use. A set of seven classes in each group describes the suitability within each category for a use, Class 1 being most desirable. The data base was used to retrieve, analyze, and produce land capability statistics and land use maps for the proposed Glengowan Dam and reservoir on the Thames River, Ontario. The method, as illustrated in this paper, analyzed impacts at different levels, facilitated data profiling and assessment in areas where little information was available, and offered a spatial perspective for evaluation and communication. (Cassar-FRC)
W82-00338

**GARRETT COUNTY WATER-WELL RECORDS, CHEMICAL-QUALITY DATA GROUND-WATER USE, COAL TEST-HOLE DATA AND SURFACE-WATER DATA.**
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W82-00395

**ALTITUDE OF WATER TABLE, BISCAYNE AQUIFER, DADE COUNTY, FLORIDA, MAY 1980,**

Geological Survey, Miami, FL. Water Resources Div.
K. W. Ratzlaff.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 81-808, 1981. 1 Sheet.

Descriptors: *Water table, *Maps, *Contours, Low flow, Water level, Water management, *Florida, Dade County, Biscayne aquifer.

Average May water levels for the Biscayne aquifer in Dade County, Florida, were contoured (contour interval 1 and 2 feet) on a 1:96,000-scale map. Maps are prepared for periods of low and high water levels to provide water managers with information about water levels in Dade County and how they are affected by water-management practices. (USGS)
W82-00409

**ALTITUDE OF WATER TABLE, BISCAYNE AQUIFER, DADE COUNTY, FLORIDA, OCTOBER 1979,**
Geological Survey, Miami, FL. Water Resources Div.
K. W. Ratzlaff.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 81-807, 1981. 1 Sheet.

Descriptors: *Water table, *Maps, *Contours, Low flow, Water level, Water management, *Florida, Dade County, Biscayne aquifer.

Average October water levels for the Biscayne aquifer in Dade County, Florida, were contoured (contour interval 1 and 2 feet) on a 1:96,000-scale map. Maps are prepared for periods of low and high water levels to provide water managers with information about water levels in Dade County and how they are affected by water-management practices. (USGS)
W82-00410

**ALTITUDE OF WATER TABLE, BISCAYNE AQUIFER, DADE COUNTY, FLORIDA, MARCH 1979,**
Geological Survey, Miami, FL. Water Resources Div.
K. W. Ratzlaff.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.50 in paper copy, $0.50 in microfiche. Geological Survey Open-File Report 81-647, 1981. 1 Sheet.

Descriptors: *Water table, *Maps, *Contours, Low flow, Water level, Water management, *Florida, Dade County, Biscayne aquifer.

Average March water levels for the Biscayne aquifer in Dade County, Florida, were contoured (contour interval 1 and 2 feet) on a 1:96,000-scale map. Maps are prepared for periods of low and high water levels to provide water managers with information about water levels in Dade County and how they are affected by water-management practices. (USGS)
W82-00411

**AN OBSERVATION-WELL NETWORK CONCEPT AS APPLIED TO NORTH CAROLINA,**
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 4B.
W82-00414

**SUMMARY OF U.S. GEOLOGICAL SURVEY INVESTIGATIONS AND HYDROLOGIC CONDITIONS IN SOUTHWEST FLORIDA FOR 1979,**
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 10C.
W82-00419

**WATER-LEVEL RECORDS FOR THE NORTHERN HIGH PLAINS OF COLORADO, 1977-81,**
Geological Survey, Lakewood, CO. Water Resources Div.
R. G. Borman, and T. S. Meredith.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-637, 1981. 29 p, 2 Fig, 1 Tab.

Descriptors: *Water level, Water level fluctuations, *Wells, Aquifers, *Colorado, Northern High Plains, *Ogallala Formation.

Water-level measurements were made in 661 wells in the winter of 1980-81 in the northern High Plains of Colorado. Measurements for the winter of 1980-81 and the four preceding winters are given in a table. (USGS)
W82-00422

**WATER LEVEL DATA FOR WELLS IN AND NEAR BURIAL GROUND 3, OAK RIDGE NATIONAL LABORATORY, TENNESSEE, 1975-1979,**
Geological Survey, Knoxville, TN. Water Resources Div.
D. A. Webster, J. S. Beatty, P. M. Benjamin, and W. M. Tranum.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $6.25 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 81-489, 1981. 35 p, 2 Fig, 2 Tab, 1 Ref.

Descriptors: *Water level, *Data collections, *Observation wells, *Radioactive waste disposal, Solid wastes, Well data, Water measurement, Water level fluctuations, Hydrographs, *Tennessee, *Oak Ridge National Laboratory.

Data pertaining to wells in and near Burial Ground 3 (radioactive wastes) at Oak Ridge National Laboratory, Tennessee are presented for the period 1975 to 1979. It includes an inventory of wells, measurements of water levels, well hydrographs, and a map showing the location of the wells. (USGS)
W82-00423

**HYDROGEOLOGIC DATA FROM TEST DRILLING NEAR VERNA BEACH, FLORIDA, 1978,**
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W82-00424

**INDEX TO ACTIVE HYDROLOGIC DATA COLLECTION SITES IN FLORIDA, 1980-81,**
Geological Survey, Tallahassee, FL. Water Resources Div.
D. W. Foose, and M. E. Thagard.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $40.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-813, 1981. 308 p, 2 Fig, 4 Ref.

Descriptors: *Indexing, *Hydrologic data, *Groundwater, *Surface water, *Sites, Gaging stations, Data collections, Water quality, Wells, Networks, *Florida.

There are about 5,000 active data collection sites in Florida operated by the U.S. Geological Survey in cooperation with State, local, and Federal agencies. This index shows the location of each site, the cooperators supporting the data-collection activities, the type and frequency of the data collected, and the U.S. Geological Survey Office responsible for collecting and processing the data. (USGS)
W82-00425

# 8. ENGINEERING WORKS

## 8A. Structures

**MODEL STUDY OF A BOX-INLET CHUTE SPILLWAY AND SAF STILLING BASIN,**
Science and Education Administration, Stillwater, OK. Conservation Structures Lab.
W. R. Gwinn.
Agricultural Reviews and Manuals ARM-S-17, July 1981. 16 p, 16 Fig, 4 Tab, 4 Ref.

Descriptors: *Spillways, *Stilling basin, *Riprap, *Model studies, Flood control, *Hydraulic design, Maximum probable floods, Scour, Design flood, Stillwater Creek, Boomer Lake, Oklahoma.

Boomer Lake at Stillwater, Oklahoma, is being considered for incorporation into the flood control plan as site 23 for Stillwater Creek, to which Boomer Creek is tributary. The present concrete spillway will pass only 46% of the probable maximum flood (PMF) without overtopping the earthen embankment. A structure is being developed to contain the specified design flood. A scale model of a proposed box-inlet chute spillway and Saint Anthony Falls (SAF) stilling basin for Boomer Lake was tested to determine the head-discharge rating and required riprap. Test results indicate that the riprap should have a mean diameter of 1 foot or more and that the trapezoidal channel at the stilling basin exit should have 3:1 side slopes, with the bottom as wide as the distance between the basin sidewalls and level with the top of the end sill. The channel should be excavated to a depth equal to the maximum scour depth plus normal riprap thickness (2ft). By providing extra thickness in the area of scour, the basin will form its own natural shape if and when the extreme flows occur. (Moore-SRC)
W82-00046

**FLOATING BREAKWATER,**
Industrie Pirelli, S.p.A., Milan (Italy). (Assignee).
A. Angioletti.
U.S. Patent No. 4,234,266, 6 p, 2 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 3, p 1054, November 18, 1980.

Descriptors: *Patents, *Breakwaters, *Engineering structures, Barriers, Floating, Waves, Shore protection.

A floating breakwater has two closed buoyant cylindrical members spaced laterally from each other and joined together in their spaced position by longitudinally spaced flexible and inextensible strips such as rubberized fabric. Closed elongated tubular members are mounted on the cylindrical members where they will be above water. The breakwater is anchored to the bottom of the waterway by chains or the like and conventional anchors. An object of the invention is to provide a flexible floating breakwater that insures excellent protection from wave motion for an enclosed area of water and any structures on or in the water lying behind the breakwater structure. (Sinha-OEIS)
W82-00067

**OPTIMAL DESIGN OF WATER CONVEYANCE SYSTEMS,**
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 6B.
W82-00160

**THE LIMITATIONS AND USEFULNESS OF STREAMFLOW GENERATION METHODS: A CASE STUDY,**
Saskatchewan Univ., Saskatoon. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W82-00229

**ICE PROBLEMS AT A COOLING WATER INTAKE IN A TIDAL ESTUARY AT LINGAN, N.S.,**

Albery, Pullerits, Dickenson and Associates Ltd., Don Mills (Ontario).
S. Skarborn, and T. Korol.
Canadian Journal of Civil Engineering, Vol 7, No 2, p 225-232, 1980. 6 Fig, 1 Tab, 11 Ref.

Descriptors: *Cooling water, *Intakes, *Ice, Powerplants, Electric powerplants, Seawater, Estuaries, *Nova Scotia, Anchor ice, Frazil ice, Ice cover, Sea ice, Recirculated water, Canals.

Design considerations for a salt water cooling water system in a coal-fired generating station in northern Nova Scotia are described. Engineers had to study regional ice conditions; alternative sites for intakes and outfalls (near shore, medium water depth, or deep water); the bathymetry, current tides, and waves of the Bridgeport Basin channel; water temperature and salinity; local ice conditions (shorefast ice, pack ice, and frazil); channel intake design (a rubble structure extending to steel sheet pile cells which support ice booms); and the canal flow characteristics with and without ice cover. In the canal connecting the sea to the plant, water would reach the pumphouse in 15 min with no ice cover and in 13 min with ice cover at a flow rate of 25.5 cu meters per sec. Provision for recirculation of cooling water was made in case of an ice buildup at the intake. The discharged water would be let out 50 meters upstream of the pumphouse to melt some of the ice and mix thoroughly with canal water. (Cassar-FRC)
W82-00230

**NORTHEASTERN NEW JERSEY GRAPPLES WITH A DROUGHT,**
New Jersey Dept. of Environmental Protection, Trenton.
J. O'Dowd.
Public Works, Vol 112, No 6, p 74-77, June, 1981.

Descriptors: *Drought, *Reservoir operation, *Pipelines, *Pumpage, *Project planning, Water deficit, Water shortage, Water yield, Reservoirs, Water transport, Conveyance structures, Flow rates, Flow discharge, Low flow, Emergency water supply, *New Jersey.

Arrangements for temporary facilities for emergency water supply during the 1980 drought in New Jersey are described. Numerous federal and state agencies cooperated in funding and planning short and long term solutions to the water supply problem. A pipeline diverting lake water to a nearby reservoir was constructed. Water was pumped from a 100 foot deep well in New York and transported through high pressure pipes along the George Washington bridge to New Jersey. Pumping water from abandoned mines has also been explored. Additional connections to existing reservoirs are being constructed for the transfer of water. (Titus-FRC)
W82-00289

**ENGINEERING RESEARCH AND THE WATER INDUSTRY,**
Water Research Centre, Marlow (England).
M. Rouse.
Water, No 31, p 7-9, March, 1980.

Descriptors: *Water mains, *Sewers, *Research priorities, *Great Britain, Sewer systems, Water conveyance, Maintenance, Needs assessment, Engineering, Technology, Design criteria.

The Water Research Centre in Great Britain has created an Engineering Group which will concentrate its efforts on underground technology, materials, and instrumentation. Initial work by the Group will consist of developing information on sewers and water mains and conducting full scale field investigations of survey methods and pipe renovation systems. Research and development will center on increased understanding of the mechanisms leading to problems and failures and development of effective data collection systems and survey methods. The Standing Technical Committee on Sewers and Water Mains provides a forum in which Water Research Centre staff can work with the users of the research and development results. The Standing Technical Committee has conducted such activities as a study designed to measure leakage and the effectiveness of leakage control measures. Research and development efforts will attempt to focus on total problems, establishing the approach and technology needed to effectively solve existing problems. Problems which are likely to arise in the future will also be addressed. Advances in technology which may benefit water conveyance will be examined. Operational innovations will be initiated and encouraged by the Centre, but much of the innovation will be accomplished by suppliers and/or within the water industry itself. (Carroll-FRC)
W82-00313

**DAM CONSTRUCTION IN CHINA.**
International Water Power and Dam Construction, Vol 33, No 4, p 17-18, April, 1981.

Descriptors: *Peoples Republic of China, *Dam construction, *Dam design, Asia, *China, Irrigation, Earth dams, Gravity dams, Hollow dams, Arch dams.

Dam construction has been an essential tool in China's development over the past 2000 years. China has about 86,000 dams, with earthfill dams being the most common type. The use of a concrete base and a thin wall of clay inside the earthfill to provide some stiffening has proved a useful technique on river beds with thick layers of gravel subject to serious seepage. The sluicing-siltation method involves depositing loess in ponds lying higher than the crest of the dam to create a high-concentration slurry and then releasing the slurry through ditches to the construction surface of the dam embankment, where it forms a solid layer as the water drains. This method has provided an efficient, labor-saving, and relatively inexpensive means of dam construction. About 5200 irrigation networks throughout the country provide water to a total of over 46,000,000 hectares. Most of the dams are small projects, financed by rural people's communes and built between two flood seasons. Hundreds of masonry dams have been built in the country; one of these is still operating normally after 2000 years of service. While most of the masonry dams built before 1960 are of the gravity type, recent constructions have used light-type dams which incorporate a single-arch retaining wall for narrow gorges or multiple arches or hollow gravity dams on wide rivers. The giant Gezhouba dams currently being constructed on the Yangtze river in Hubei province will include two powerplants with a combined capacity of 2.7 GW, three locks (one of which will be among the largest in the world), a flood gate, and two silt gates. Many dams are now being built on China's largest rivers. (Carroll-FRC)
W82-00334

**A NEW ERA FOR CHINA'S HYDROPOWER,**
Manitoba Univ., Winnipeg. Dept. of Geography.
V. Smil.
International Water Power and Dam Construction, Vol 33, No 4, p 23-25, April, 1981. 1 Fig, 2 Tab.

Descriptors: *People's Republic of China, *Hydroelectric power, *Dam construction, Asia, *China, Planning, Dams, Electric power production, Powerplants.

Political changes in the People's Republic of China in the 1970's have ushered in an era of industrial modernization and economic development. A central focus of this effort has been the assignment of top priority to the development of hydroelectric power in the country. Bold development plans have included the proposed construction of several giant hydroelectric projects. China is also, for the first time in over 20 years, seeking foreign technical and financial assistance in designing and constructing several large planned projects. Twelve major hydroelectric plants, with total capacities of about 11 GW, are currently in various stages of construction. The largest of these is the Gezhouba on the Yangtze River, which will be 2561 meters long and 70 meters high. This dam will include two generating stations with a total capacity of 2715 MW and an annual production capacity of 13.8 TWh. The project will include three ship locks, a central sluice gate for flood control, and a dozen discharge tunnels to remove silt. Both Japan and the United States have agreed to provide loans and technical assistance for hydroelectric power development in China. (Carroll-FRC)
W82-00335

**CHINA'S POTENTIAL FOR HYDRO DEVELOPMENT,**
C. Weigong.
International Water Power and Dam Construction, Vol 33, No 4, p 18-21, April, 1981. 3 Fig, 1 Tab.

Descriptors: *People's Republic of China, *Hydroelectric power, Electric power, Planning, *China, Dam construction.

Surveys of the most important rivers in China have indicated that the total theoretical hydroelectric power potential in the People's Republic of China is 680,000 megawatts, corresponding to an annual generation of 6000 TWh of electrical energy. Although China has more water power resources than any other country, it has developed only 2.4% of the exploitable potential, with combined generating capacity of hydroelectric power installations totaling 16.02 GW. Southwest China, which includes the provinces of Sichuan, Yunnan, and Guizhou and the Tiber autonomous region, accounts for 69% of the total water power potential in the country and for about 40% of the total developed hydroelectric power. Five additional major hydropower systems currently planned for this region will serve both Southwest China and the industrial areas in East China, which are short of energy. Northwest China possesses about 12.3% of China's total hydropower resources, while Central and South China account for 9.4% of the national total. East, Northeast, and North China account for relatively negligible percentages of the total hydropower potential, and most of this has already been developed. Major planned projects in Southwest China, Northwest China, Central and South China, and East China are briefly described. (Carroll-FRC)
W82-00336

**A LABORATORY MODEL FOR UNDERWATER CONSTRUCTION OF A DAM,**
University of the Witwatersrand, Johannesburg (South Africa).
For primary bibliographic entry see Field 8D.
W82-00347

**HYDRAULIC SEDIMENT MODEL STUDY FOR PROPOSED BLANCO DIVERSION DAM MODIFICATION,**
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. A. Dodge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-122920, Price codes: A03 in paper copy, A01 in microfiche. Report REC-ERC-81-3, June 1981. 48 p, 42 Fig.

Descriptors: *Diversion dams, *Sediment control, *Hydraulic models, Headworks, Model studies, Trash racks, Trap efficiency, Tunnels, Suspended sediments, Hydraulic design, *Blanco Diversion Dam, *San Juan-Chama Project, Colorado, New Mexico.

Blanco Diversion Dam is the uppermost and largest of three dams on the San Juan-Chama Project. During a heavy runoff of water in 1973, operators reported large quantities of sediment passing through the headworks and tunnel. Sediment passing through the Blanco Tunnel headworks travels through about 40 km of tunnel. A 1/16-scale sediment model was used to study proposed modifications of Blanco Diversion Dam. Pit-run sand was used to simulate bed sediment sizes ranging from cobbles to fine sand, including sizes in the coarsest 7% part of suspended sediment samples. The model was verified with hydrologic estimates and field data. Tests were directed toward keeping coarse sediment out of the headworks, making sluicing of sediment less troublesome to downriver water users, reducing trash problems on the headworks rack, and keeping sediment from inter-

fering with downstream water measurement. A three-part sequential trap system in front of the headworks was developed. This system uses sluicing over successive trap walls and reduces the amount of sediment entering the tunnel to about 19% of that entering the existing system during 1971 to 1975. At lower river flows, the traps reduced the grain size of the sediment entering the tunnel to 1/20 that of the riverbed material, and at higher riverflows the reduction was to 1/5 that of the riverbed material. (Moore-SRC)
W82-00446

## 8B. Hydraulics

**SECONDARY FLOW, SHEAR STRESS AND SEDIMENT TRANSPORT,**
Pittsburgh Univ., PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W82-00117

**RESONATOR STUDIES FOR KINCARDINE HARBOUR, LAKE HURON,**
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
W. James, and D. R. Cuthbert.
Canadian Journal of Civil Engineering, Vol 7, No 1, p 133-143, 1980. 10 Fig, 2 Tab, 8 Ref.

Descriptors: *Resonance, *Harbors, *Waves, *Kincardine Harbor, *Lake Huron, Boating, Recreation, Surveys, Acoustics, Model studies, Lakes, Breakwaters.

A series of acoustical models was used to study wave action in Kincardine Harbor, Lake Huron. Installation of sheet steel piling on the original concrete quays had produced excessive waves in the harbor, used primarily for pleasure boating. Subsequently, a resonator and rubble breakwater were constructed to exclude wave energy from the harbor. A public opinion survey of users indicated that the resonator was effective in decreasing inner harbor oscillations, but posed a navigational hazard. Conclusions were: (1) the acoustic model effectively simulated harbor resonance, (2) the existing breakwater should be extended and marked with a light, and (3) no more than two resonators of unequal lengths (60 and 80 ft) should be constructed. A utility function was proposed; it indicates an average condition of the harbor in relation to outside wave conditions. (Cassar-FRC)
W82-00228

## 8C. Hydraulic Machinery

**OPTIMIZATION OF PUMP TURBINES,**
Technische Univ., Munich (Germany, F.R.).
J. Raabe.
Journal of the Energy Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EY1, p 41-63, May, 1981. 15 Fig, 29 Ref.

Descriptors: *Cost analysis, *Electric power production, *Pump turbines, *Mathematical studies, Costs, Economic aspects, Powerplants, Electric power, Turbines, Design criteria, Computer models, Model studies, Impellers.

Some costs involved with excavation work and mechanical losses which occur during the operation of pump turbines of electrical powerplants are presented. The pump turbine design should be based on an impeller outside diameter which minimizes losses from disc friction and the diffuser during pumping. This diameter may be derived mathematically as a function of the given head, flow rate, and type number. A new technique applied to calculating the type number also aids in reducing internal losses and keeps the costs of excavation to a minimum. The optimum type number is functionally related to geometrical data, cavitation coefficients, and loss. Computed results were in close agreement with values encountered in actual practice on a modern pump turbine. The pump turbine design must also take into account specific properties associated with the operation of the set. (Geiger-FRC)
W82-00181

**THE CASE FOR SPECIFYING AWWA BUTTERFLY VALVES.**
Water and Sewage Works, Vol 127, No 3, p 46, 51, March, 1980.

Descriptors: *Valves, *Design considerations, Equipment, Mechanical equipment, Wastewater treatment, Water treatment, Water treatment facilities, Wastewater treatment facilities, Standards, AWWA, Valves, Butterfly valves.

Basic criteria which a butterfly valve must meet to satisfy the minimum requirements of the AWWA standard are that the materials have a basic safety factor of 5:1 on the ultimate tensile strength or 3:1 on the yield strength, whichever is lower. The standard also covers the operator structure. Manual-type operators must satisfy the minimum requirements of two times the rated torque without damage to internal components. Other requirements are listed. Stringent test procedures are also contained in the AWWA standard C504; these impose significant requirements on quality and long-term cycle life for butterfly-valve applications. The clear interpretation of federal specification guidelines offers the consulting engineer the necessary freedom to specify AWWA-quality valves for EPA projects, notably municipal water and wastewater systems. (Baker-FRC)
W82-00213

**CAVITATION AND WEAR ON HYDRAULIC MACHINES,**
Chengdu Agricultural Machinery Coll. (China).
DuTong.
International Water Power and Dam Construction, Vol 33, No 4, p 26-28, 33-35, April, 1981. 6 Fig.

Descriptors: *Hydraulic machinery, *Cavitation, *Abrasion, Fluid mechanics, Hydraulic equipment, Flow friction, Sand, Maintenance, *Design criteria.

It has been widely assumed that the scaly pitting of hydraulic machinery is a typical characteristic of wear caused by the abrasion of sand contained in flowing water. Several experiments and analyses were conducted to determine whether such damage is caused by sandy water or by cavitation, including comparison of sand-washing attacks under normal atmospheric conditions and in a compressed air environment; tests with a straight tube and a cavitation generator; tests with a bent tube; tests with pumps connected in series; and tests with water passages connected in series. These tests demonstrated that when no cavitation existed, the wearing effect from the sand alone resulted in all surfaces becoming smooth, with some becoming deep brown in color while others showed a metallic lustre, regardless of the size of the sand grain. Thus elimination of cavitation will eliminate scaly pitting and other surface damage to hydraulic machinery. When sand is present in flowing water it promotes the development of bubbles, and the onset of cavitation occurs sooner than it would have in the absence of the sand. In addition, the sand will continuously wash away the protective film formed on the damaged surface by cavitation so that the sound material of the machinery is successively exposed to the action of cavitation. Sand has a direct influence on cavitation effects, intensifying deterioration and contributing to the development of long scaly pits which join to form channels along the direction of the flow stream. When hydraulic machinery will be operating in water containing a considerable amount of sand, the prevention of cavitation is one of the most important design criteria. The presence of cavitation is the essential condition for corrosion, rather than the amount of sand the water contains. (Carroll-FRC)
W82-00331

**HYDRAULIC GATES: THE STATE-OF-THE-ART,**
Internacional de Engenharia, Rio de Janeiro (Brazil).
P. C. Erbiste.
International Water Power and Dam Construction, Vol 33, No 4, p 43-48, April, 1981. 5 Fig, 5 Tab, 5 Ref.

Descriptors: *Hydraulic gates, *Design criteria, *Surveys, Hydraulic equipment, Gates, Hydroelectric power, Flood control, Statistical data, Design standards.

The selection of a suitable gate is one of the most important tasks of design engineers for hydraulic installations. Gate selection should be based on a complete analysis of factors which could influence performance, cost, quality, and reliability of the equipment. Past experience with successful types and local manufacturing capability should also be considered. The increasing sizes of hydroelectric power installations and flood control schemes have led to requirements for larger hydraulic gates and extensions of operating limits. Gates are also often built to the maximum allowable dimensions and heads for the gate type. The author of this article conducted a review of the state-of-the-art of hydraulic gates in 1978-1979. Summary data from this study are presented. Data are presented on the project, manufacturer, quantity, span, height, area, head, and hydrostatic load of each of the 15 largest of each type of high pressure gate, under underflow spillway gate, overflow spillway gate, and overflow and underflow spillway gate. Data are also presented on the current limits of the size and head for various types of gates. These data are intended to outline the present fields of application of gates and to assist engineers in the preliminary selection of a gate type. (Carroll-FRC)
W82-00332

## 8D. Soil Mechanics

**PERFORMANCE OF GRANULAR SOIL COVERS ON CANALS,**
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. W. Jones.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-104696, Price codes: A04 in paper copy, A01 in microfiche. Report REC-ERC-81-7, August 1981. 70 p, 49 Fig, 1 Tab, 9 Ref, Append.

Descriptors: *Canal linings, *Erosion control, *Soil stabilization, Soil physical properties, Soil moisture, Sand, Freezing, *Seepage control, Channel erosion.

For canals that do not have concrete or other hard-surfaced, exposed-type lining, selected granular soils are often used as erosion resistant covers at the canal-water interface. Such covers are also needed on most membrane type linings provided for seepage control to hold them in place, protect them from exposure to the elements, and prevent damage to the membrane. The characteristics and observed stability of fine and coarse soil cover layers placed on 19 selected earth-lined and unlined canal reaches to resist water erosion and to protect asphalt and plastic membrane linings are reported. Soils which have generally performed well in coarse cover layers on canals with tractive forces less than 5 N/sq m have contained: maximum particle sizes between 75 and 150 mm; less than 50% passing a No. 4 sieve, and less than 10% passing a No. 200 sieve. Predominantly medium to coarse sand in the fine layer may cause the coarser layer to be unstable during canal filling and drawdown. Some cover soils placed loosely without moisture or density control will settle when water is introduced into a canal and cause cracks to form. In cold climates, freezing of soil moisture drawn to the underside of a membrane lining may cause sliding of the membrane on the subgrade during periods of thawing. (Moore-SRC)
W82-00047

**SHEAR STRENGTH OF ROCKFILL,**
Terra Tek, Salt Lake City, UT.
N. Barton, and B. Kjaernsli.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No GT7, p 873-891, July, 1981. 12 Fig, 2 Tab, 27 Ref.

Descriptors: *Rock fill, *Rockfill dams, *Strength, Rocks, Dam stability, Dam design, Leakage, Porosity.

A method was developed to estimate the peak drained friction angle of rockfill consisting of angular quarried rock, moraine, or well-rounded fluvial gravels. The peak drained friction angles of rock joints and rockfill are quantified by an equivalent roughness, an equivalent asperity or particle strength, and by the residual or friction angle. Each of these parameters can be estimated by simple index tests or by classification. The peak drained friction angle for rockfill and rock joints is inversely proportional to the log of effective normal stress. This is a positive factor in the toe region of a rockfill dam, as high values in this region can explain the high resistance to raveling during extreme leakage. Checking full-scale strength and porosity in different lifts of a dam or in a trail fill prior to dam construction may be accomplished using large-scale tilt testing of in-place compacted rockfill. (Small-FRC)
W82-00116

**ESTIMATING END-OF-CONSTRUCTION PORE-PRESSURES IN UNSATURATED EARTH EMBANKMENTS,**
Pretoria Univ. (South Africa).
G. W. Annandale.
Civil Engineer in South Africa, Vol 22, No 2, p 31-313, February, 1980. 5 Fig, 6 Ref.

Descriptors: *Pore pressure, *Embankments, Earthworks, Water pressure, Mathematical studies.

A method is presented with which the end-of-construction pore-air pressure in an embankment can be estimated. This method takes into account the degree of saturation of the soil as well as dissipation of excess pore-air pressure during construction and allows reasonable settlement and stability estimates. The distribution of end-of-construction pore-air pressure can also be studied. (Baker-FRC)
W82-00194

**A LABORATORY MODEL FOR UNDERWATER CONSTRUCTION OF A DAM,**
University of the Witwatersrand, Johannesburg (South Africa).
Z. Ofer.
Civil Engineer in South Africa, Vol 23, No 1, p 17-21, January, 1981. 8 Fig, 10 Ref.

Descriptors: *Dam construction, *Earth dams, *Rockfill dams, Dam stability, Cofferdams, Permeability, Structural models, Design criteria, Model studies.

A small-scale (270 mm high) model dam was built in the laboratory by dumping soil-stone mixtures into water. Two concepts were tested: (1) dumping of pre-mixed soil-stone mixture and (2) placement of a stone core covered with a soil layer on the upstream side. A total of 18 tests were conducted, using different combinations and types of stone and sand. A stone-dolerite soil mixture dumped in water provided a feasible solution for constructing a cofferdam in a lake. The high permeability of the mixture was reduced by placing a layer of fine impermeable material on the upstream slope. Larger proportions of stone improved stability, and larger proportions of soil decreased permeability. Use of non-plastic or very low plasticity materials was not as effective. Over a period of 15 days the permeability of the stone-dolerite dam decreased to 20% of the initial rate. This was caused by the finer particles entrapped in the spaces between the rocks. These small-scale studies may not reproduce on a full scale because of scale effects. (Cassar-FRC)
W82-00347

## 8G. Materials

**LINING OF WASTE IMPOUNDMENT AND DISPOSAL FACILITIES.**
Matrecon, Inc., Oakland, CA.
For primary bibliographic entry see Field 5E.
W82-00099

# 10. SCIENTIFIC AND TECHNICAL INFORMATION

## 10B. Reference and Retrieval

**GROUND-WATER INFORMATION: NWWA PROVIDES THE RESOURCES,**
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 2F.
W82-00301

**NATIONAL WATER DATA EXCHANGE (NAWDEX) SYSTEM 2000 DATA RETRIEVAL MANUAL,**
Geological Survey, Reston, VA. Water Resources Div.
O. O. Williams, and W. A. Knecht.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $26.25 in paper copy, $6.50 in microfiche. Geological Survey Open-File Report 81-419, 1981. 196 p, 18 Fig, 8 Append.

Descriptors: *Data storage and retrieval, *Hydrologic data, *Training, *Information retrieval, Computer programs, *NAWDEX(National Water Data Exchange), Water Data Sources Directory, Master Water Data Index.

The manual offers general instructions on the use of SYSTEM 2000 to retrieve any type of data, and specific instructions on how to retrieve data from the U.S. Geological Survey's Water Data Sources Directory and Master Water Data Index Data Bases. The manual is divided into five major sections plus six appendixes for reference. Section I contains introductory material, including the purpose and scope of the manual, instructions on how to use the manual, basic computer concepts, and basic SYSTEM 2000 concepts. Section II contains basic instructions on retrieving and displaying data, and section III goes into more complex retrievals. Section IV explains how to make efficient use of techniques developed in sections II and III. Section V summarizes and discusses practical applications, and section IV contains all the appendixes required for reference. (USGS)
W82-00420

## 10C. Secondary Publication And Distribution

**SUMMARY OF U.S. GEOLOGICAL SURVEY INVESTIGATIONS AND HYDROLOGIC CONDITIONS IN SOUTHWEST FLORIDA FOR 1979,**
Geological Survey, Tallahassee, FL. Water Resources Div.
H. C. Rollins.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $12.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-78, 1981. 93 p, 48 Fig, 3 Tab, 7 Ref.

Descriptors: *Water management, *Publications, *Bibliographies, Groundwater, Surface water, Water quality, Streamflow, Water supply, Water use, Water resources development, Reviews, Hydrologic data, *Florida, Southwest Florida, *Geological survey projects.

This report summarizes water-resources investigations in the Southwest Florida Water Management District performed by the U.S. Geological Survey, Water Resources Division, for fiscal year 1979. The investigations are part of the Federal program of appraising the nation's water resources. The cooperative program for fiscal year 1979 included 37 interpretive investigations. Abstracts of 15 reports released during 1979 are included. The hydrologic setting of southwest Florida and discussions of surface-water, groundwater, and quality-of-water conditions are given. Hydrologic conditions in southwest Florida are described and illustrated by hydrographs of selected surface-water, groundwater, and lake-stage data-collection sites. In addition, summaries of water-use data and data on the regional observation monitor-well program are provided. (USGS)
W82-00419

## 10D. Specialized Information Center Services

**DIRECTORY OF MEMBER ORGANIZATIONS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),**
Geological Survey, Reston, VA. Water Resources Div.
J. M. Nokes, and C. D. Blackwell.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price codes: $8.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-497, 1981. 59 p. (Supersedes Open-File Report 80-556).

Descriptors: *Data storage and retrieval, *Hydrologic data, *NAWDEX(National Water Data Exchange), Directories, Member organizations.

The National Water Data Exchange (NAWDEX) is a national confederation of water-oriented organizations working together to improve access to water data. It consists of member organizations from all sectors of the water-data community. This Directory provides the names, addresses, and telephone numbers of all NAWDEX member organizations and their designated NAWDEX representatives. (USGS)
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